

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87303	0	0	0	0	The headline statements are a great invention of WG I AR5 team. These need to be understandable to policy makers, media and a broad audience. Taken together these could make a great 'summary of a summary' of the main key messages. However the headline statements in this SPM are often written in a too technical language. Process suggestion: I recommend to involve the communication experts of WG I (and perhaps those of the IPCC Secretariat as well) to working on these statements with the authors - the latter will have the last word of course. NB a pitfall in writing headline statements is the urge to summarize everything that is in a section, making an attempt to be comprehensive in just a few lines. This often leads to bland sentences that are both true and open doors ("truisms"). Better to select salient statements from a section that are important to policy makers, if possible with quantitative information. AR5 WG I SPM gives great examples! [Marcel Berk, Netherlands]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets.
87305	0	0	0	0	The readers may not yet be familiar with SSPs while an explanation in the SPM is lacking, and the description of SSPs in the Glossary is not a full explanation. More can be found in C 1 Cross chapter box 1.5, but no description of the SSP narratives here either. A full explanation of the SSPs and its assumptions may be given in either WG II AR6 or WG III AR6 but that does not help here. I suggest to take up brief descriptions of the SSPs, and their narratives in the Glossary (could be done in a Box as well but that would make the SPM even longer.) An example of short descriptions of the SSPs can be found in Box A7 from the FD SPM of SRCL. I quote: "SSP1 is a pathway with low population growth (~7 billion in 2100), high income and reduced inequalities, effective land use regulation, less resource intensive consumption, including lower meat consumption and lower food waste, open trade and deployment of environmentally friendly technology. SSP2 is a pathway with medium population growth (~9 billion in 2100), medium income; technological progress and consumption patterns are a continuation of past trends, and only gradual improvement in inequality occurs. Compared to SSP 1 changes start later and are less effective. SSP3 is a pathway with high population (~13 billion in 2100), low income, material-intensive consumption, barriers to trade, and slow rates of technological change. The way in which the risks posed by climate change differ under each pathway" [Marcel Berk, Netherlands]	Rejected. It is not possible for us to include a complete description of the SSPs in the SPM, due to space constraints and because it is not within the mandate of WGI to cover the development and socio-economic assumptions behind the SSPs, which is within the mandate of WGIII. Note however that more information about the SSP is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4, which are all provided as lines of sight in box SPM.1.
131625	0	0	0	0	There are only two statements on urban areas and climate change in the whole SPM, but a whole Box on Urban Climate in the Technical Summary. Cities/ mayors are a very relevant group of policymakers as many of them are already engaged in climate change. There should be more information of projected risks/ changes for urban areas in the SPM [Hans Poertner and WGII TSU, Germany]	Rejected. Urban areas are now only covered in HS11.5 covering the assessment results from the TS.Box. While we agree that this is an important topic, but with limited in space in the SPM and the fact that the coverage of cities is relatively limited in the report, we feel the SPM covers the main findings we have on this topic.

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90159	0	0	0	0	While generally support the structure of the present SPM, which follows a policy-relevant storyline. We consider however that its length needs to be considerably reduce to give policy-makers a possibility to read it. For the moment, we consider it includes a lot of rather theoretical information, which while not being wrong, is not policy relevant. We consider that the whole section A could be deleted, and only some main short messages included in present section B. In addition, section D.5 could be entirely deleted. We will give further indications in our comments where we think that deletions and repetitions could help to further reduce the length. [Georges Gehl, Luxembourg]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.
90161	0	0	0	0	We strongly encourage keeping the headline messages of the different section of the SPM as, taken together, they convey a concise and complete summary to policy-makers of the main findings of the report. They should be written in a language easily accessible for policy-makers and be as short as possible. We will do detailed comments throughout the SPM to achieve these two goals. [Georges Gehl, Luxembourg]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets.
90163	0	0	0	0	On the structure of the SPM, we consider that section D.1 contains a lot of very policy relevant information, and should be moved to a much more prominent place in the SPM, which would ideally be at the beginning. [Georges Gehl, Luxembourg]	Rejected. Moving Section D to the beginning of the SPM would not fit the narrative of the SPM that has been developed over several months.
90165	0	0	0	0	We encourage the authors to develop Figures for the SPM that can easily be used in presentations, and thus follow the principle of "one message, one figure" (a very limited amount of messages being acceptable too). In addition, the Figures in the SPM should be less more technical than those of the TS to be easily accessible for policy-makers. The collaboration with communication specialists is highly encouraged. While we recognize that, the authors tried to follow these approaches in the Figures that are proposed, we think that Figure SPM.1, SPM.1 and SPM.4 are to a certain point redundant. We would propose to extract the main parts of these Figures and merge them into one Figure. [Georges Gehl, Luxembourg]	Taken into account. In the revised SPM, the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Additionally, each figure includes a very clear intent that is written down and that is visually shown by the figure itself. Each figure has also been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers.
86885	0	0	0	0	Please consider including an answer to the following question: "What are the key new findings in AR6 WG1, compared to AR5 WG1?". For example as an additional FAQ, or table to be presented in addition to the report itself. [Oyvind Christophersen, Norway]	Taken into account. The revised introduction of TS now includes Selected Updates and/or New Results since AR5/the special reports.
86887	0	0	0	0	We appreciate that every section in the SPM is starting with a preambular text that guides the readers, and additionally gives them some expectations on what is to follow. [Oyvind Christophersen, Norway]	Noted with thanks.

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86889	0	0	0	0	Regarding highlighted conclusions. We very much appreciate the use of highlighted conclusions, and support strongly the use of them in the SPM. However, and in general, we think that in the draft, many of them are currently too long and includes information that are only repeated word-by-word in the associated bullets below. In our view, it would be preferably if the highlighted conclusions where formulated more informatively to only grasp the most policy relevant information from the associated and more precicely formulated bullets below. We also question the use of, and if there really is a stringent need of, referencing the underlying report and chapters in the highlighted conclusions themselves. Obviously the referencing is of uttermost importance in the associated bullets below, but maybe not as important in the highlighted conclusions themselves. One alternative approach could be to make a reference footnote to every headline conclusion, but keep them in the bullets. To the extent possible, the headline conclusions should be drafted in a plain language, avoiding technicalities, so that policymakers can more easily understand what you are trying to convene. [Oyvind Christophersen, Norway]	1) headline statements - accepted. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets. 2) line of sight - rejected - as per past practice (e.g. SR1.5: https://www.ipcc.ch/sr15/chapter/spm/) , we have decided to the keep the references to the underlying report in the headline statements.
86891	0	0	0	0	Please bear in mind that the highlighted conclusions should ideally be formulated in a way that is easily understandable for policymakers. In their current form, and especially for some of them, one really needs to read quite carefully the Box SPM.1: "Core concepts central to this report" to understand what they are covering. E.g use of only one of the terms in internal and natural variability might create some confusion, and to intuitively understand that climatic impact drivers includes both natural and human-induced perturbations will be challenging for non-experts. [Oyvind Christophersen, Norway]	accepted. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets.
69279	0	0	0	0	The overall readability should be enhanced, including especially for non-native English speakers, and the sentences should be kept succinct. The salient features and differences from AR5, including the three SRs (SR1.5, SRCCL, SROCC), would merit mentions in the SPM. Other technical and detailed contents could be sorted into, for instance, the Technical Summary as appropriate. [Kaoru Magosaki, Japan]	Taken into account. The revised SPM is much shorter and uses simpler, clearer language. The new version of the SPM now introduced all three SRs in the introduction. Please see the Technical Summary for key updates from the AR5 WGI and the three Special Reports. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
106147	0	0	0	0	The world is experiencing one of the most extremes of global pandemic in the form of COVID-19 this year. Can we elaborate the connections of this pandemic with the issues of changing climate? I think AR6, in general (if not specifically), need to address this big FAQ and provide knowledge-commentary on this nexus. One of the chapters could include this critical most FAQ/issue of this time that the world is facing. Leaving this for IPCC AR6 to provide some useful information in this line (if possible) [Atiq Kainan Ahmed, Thailand]	Taken into account, a box describing the effects of the COVID-19 restrictions for emissions, air quality and climate as far as it was documented in the scientific literature in January 2021 has been added to the chapter 6 and the SPM (D2.1 statement) summarizes this assessment.

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86445	0	0	0	0	Whilst we very much appreciate that this is the first draft of SPM, we would like to see it be shortened, at least by half, and focussing only on the most important messages that include new findings since AR5 and SRs of the AR6 cycle. The current draft includes duplications - removing these will also help to shorten the draft. Also, SPM is written in a technical language that is accessible for scientists but not easily understandable for policymakers. It would be much appreciated if the SOD of SPM could use less technical language. [Ala Taimar, Estonia]	Accepted. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
86447	0	0	0	0	SPM should include more information on precipitation and water cycle impacts. Seasonal precipitation changes and their impacts should be included. [Ala Taimar, Estonia]	Rejected. Risk and impacts are within the mandate of WGII
86449	0	0	0	0	Please include a figure on radiative forcing by emissions and drivers (similar to the figures SPM.2 in AR4 and SPM.5 in AR5). It would be good to have an up-to-date figure in SPM, as the ones from the previous reports are often used and proved to be useful. [Ala Taimar, Estonia]	Taken into account. The forcing figure is in Chapter 6. More statements on forcing added to SPM
86451	0	0	0	0	In the case of information being provided from previous reports including the SRs from AR6 cycle, this should be made clear to the reader. And if these are confirmed or improved by recent research then this should be made clear too. [Ala Taimar, Estonia]	The new version of the SPM now introduced all three SRs in the introduction. Please see the Technical Summary for key updates from the AR5 WGI and the three Special Reports. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
86453	0	0	0	0	Please provide IPCC confidence statements on all statements in SPM. [Ala Taimar, Estonia]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
107499	0	0	0	0	There are instance in the SPM where the deployment of "low confidence" language is confusing. Reporting low confidence in some statements indicates high uncertainty about high-impact scenarios. However, that understanding takes unpacking by the reader, and that is not appropriate for a Summary for Policymakers. See section 6.2 as an example. Language should be re-framed to make that clear for policy makers. [Hunter Cutting, United States of America]	Rejected. Low confidence is a term included in the IPCC guidance on uncertainty language.
87283	0	0	0	0	The SPM is way too long (57 pag A4). Moreover, an SOD SPM normally gets longer when it becomes a FD SPM, This will likely lead to great difficulties at the line-by-line SPM approval session, and could lead to mayor deletions due to lack of time. Especially whole section D is at risk as it is the last section and the subject 'limiting climate change' in a WG I SPM could be considered by some delegations as the task of WG III instead of WG I. A good standard would be a 30 pages 4 including figures, tables, maps and footnotes. It will be a mayor challenge to shorten this SPM while keeping its main policy relevant statements but it seems inevitable. [Marcel Berk, Netherlands]	Accepted. We significantly reduced the length of the revised version of the SPM.
86517	0	0	0	0	Please number the red boxes and make sure that carry the main story (summary of SPM) when read without the subsections [Ala Taimar, Estonia]	Accepted. The red boxes are now presented in blue as HS1, HS2, HS3...

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83387	0	0	200	70	I miss an updated version of the radiative forcing table (SPM.5 in AR5) [Magnus Joelsson, Sweden]	Rejected. In an improved, more policy relevant development over AR5, we are now able to calibrate emulators to the assessment, e.g. of ECS, to give a more complete assessment of historic warming from emissions. This is especially useful in the context of the SPM to provide a further line of evidence to attribution studies presented in Figure 2a.
131623	0	0			the headline statements in boxes are all lengthy, could these be shortened [Hans Poertner and WGII TSU, Germany]	Accepted. The revised headline statements have been streamlined and shortened.
99217	0	0			While I am aware that the key concepts always start the SPM off, I am wondering if for many readers these are not the main focus. Could these be moved to the end of the report for reference. [Daniela Schmidt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The box of key concept has been moved from the SPM to the TS.
15025	0	0			Important: The Summary is much too complex and convoluted to be useful to Policymakers. It should be completely revised, clarified and shortened. I suggest that it is entirely re-written in simpler and more elegant terms, eliminating: (i) all but the most familiar acronyms, (ii) All excess detail (ii) All unnecessary repetition; (iv) all cross-references. Its ideal length would be about 12 pages. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible. As a result, we got rid of numerous acronyms, we streamlined the text to avoid repetitions and unnecessary details. However, we did not remove the cross-references, as they are needed for traceability of the SPM to the rest of the report (lines of sight at the end of the statements) and it is common practice to refer to the figures/tables in the text.
15027	0	0			Supporting remark: Recently, I was asked to review a summary of the global warming threat that had been prepared by a climate lobby for the US Congress. This consisted of just four hundred words on a single page. This complex topic can not be summarised so briefly without adding confusion and controversy; the answer was that congressional staffers would not read anything longer. An example of going to the other extreme! [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Revised SPM much shorter.
54565	0		0		Length / Structure: General comment: Good first draft. Despite some lack of clarity about the purpose of Section A, overall we see what the authors have tried to do and support the overall flow of information. Don't see a need for major restructuring or additions/deletions to content. [Nancy Hamzawi, Canada]	Noted with thanks.

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54567	0		0		Attribution Statements: It is important that policymakers understand how to correctly interpret the different attribution statements in the SPM. We strongly recommend consistent phrases be used to describe similar results and that the footnotes in Ch. 3 explaining two of the consistently used phrases ("human influence has contributed to X" and 'human influence is the main driver of X') be brought into the SPM. Where additional phrases are used, correct interpretation should be clearly explained (e.g. B.3.1 "anthropogenic forcing has made a substantial contribution to....."). Ideally, these short footnotes would be supported by a somewhat lengthier discussion (e.g. a Box) that clearly explained why for changes in many climate system components, all that can be said is that human influence is non-zero ("has contributed to") which we think will be perplexing to many readers given the emphatic evidence of human influence on the climate system. If space for such a Box is limited in the SPM, then alternatively, this could be brought into Ch. 3. OR into Cross-chapter Box 1.4 (Attribution in the IPCC AR6). [Nancy Hamzawi, Canada]	Taken into account. This has been implemented in the new version of the SPM. Main driver is defined in Footnote 9.
54569	0		0		General comments on figures: 1. Figures in SPM should convey a simple, clear message, be readily understood by a broad range of readers and minimize the risk of misinterpretation. These criteria should guide selection of figures for the SPM. From this perspective, we have concerns about Figure SPM.6 and Box SPM.3 Figure 1 and do not support inclusion of these Figures in the SPM. See detailed comments on these Figures. 2. In general, while we appreciate the efforts to create multi-panel figures that tell a comprehensive story, we again stress the need to have each panel available for download individually so that the larger story can be deconstructed into simpler single messages in briefings. [Nancy Hamzawi, Canada]	1. Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible. 2. taken into account. We have tried to make each panel understandable without the rest (in terms of headings, labels, etc.). Not however that it's possible to extract the individual panels by cropping the figures.
54571	0		0		Readability / Key messages: We would encourage the authors to ensure that the set of headline statements are written in such a way as to be easy to read and understand as the key take-away messages from the SPM. [Nancy Hamzawi, Canada]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report, which are then substantiated in the supporting bullets.
54573	0		0		Calibrated language: There are many instances where confidence language is inappropriately applied to what are essentially factual statements. These cases need to be rectified as otherwise the confidence qualifiers lose their meaning and impact. In addition, a broad issue that arises in multiple places in the report is the use of IPCC calibrated language for which the basis of the assessment is obscure. We have flagged this in some specific cases, but in general, would strongly recommend that the basis for, and traceability of, all calibrated statements in the SPM are carefully checked by the authors. [Nancy Hamzawi, Canada]	Taken into account. Uncertainty language has been checked throughout the SPM and the entire report.

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54575	0		0		Line-of-sight: The references (in curly brackets) to where in the underlying chapters readers can find the supporting evidence for statements in the SPM is a critical part of the IPCC's commitment to traceability. However, we are concerned that in many cases, the references provided point to so many different places and to such a substantive amount of text that they cease to be useful for reviewers and readers to ensure line-of-sight. In some case the line-of-sight points to multiple chapters and sections which together encompass some hundreds of pages. We recommend that guidance is issued to authors about how to put references in the curly brackets and that the focus should be on providing the most relevant references to support the assessment statments. Avoiding duplication of references to the TS and then to underlying chapters is also recommended. In fact, Canada encourages the IPCC to consider whether SPM references in curly brackets should ONLY be to the TS, with more specific chapter references then provided in the TS. This would support the heirarchy of information in IPCC reports, with critical information first summarized in the TS and then a select set of the TS key findings are elevated to the SPM. [Nancy Hamzawi, Canada]	Taken into account. The lines of sight have been checked. The revised SPM builds on the summary statements from the TS, to better support the findings presented in the SPM and improve the traceability of the report.
107789	0		200		Confidence and likelihood are the core substance of your work. It could be helpful for the reader that you create a scale as to visualize more easily the point vs the global possibility. It could be more helpful if you would add this scale (like an horizontal bar chart) at each bottom page or you could also create a bookmark with these scale information. [FREDERIC MENARD, France]	Rejected. The use of calibrated language is traceable to the Guidance note published in the AR5 cycle. In the SPM figures, visual displays of confidence have been implemented (e.g., Figure SPM.3) however a visual display across each page is rejected due to space constraints.
111617	0				I found the use of multiple reference periods very confusing. At least three periods are used, just for global temperature (1850-1900, 1995-2014, 2010-2019). Some paragraphs (e.g. C.2.5) apparently even use different base periods for different variables. I suggest that as far as possible everything is referenced to an early industrial period baseline (1850-1900?), since that is the baseline for the Paris agreement, and most/all readers will be familiar with the amount of observed warming from then to present. I appreciate that for some variables/applications the change relative to 'present day' may be more directly relevant but this could be stated in parentheses when needed. I know this is a tricky problem but I think more consistency is needed. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Multiple reference period are still used in the SPM however they are more consistently used. The pre-industrial baseline is 1850--1900. Section C uses different baselines that come from cited literature and are beyond the WGI's control to modify.
81923	0				Please include in the SPM some material on developments regarding GHG metrics, such as the paragraph from the Executive Summary of Chapter 7 (page 7-8, lines 6-12) [Dan Zwartz, New Zealand]	Taken into account. HS13.7 now covers emission metrics
86537	0				This draft is very long... I understand it's still a draft, but I feel like quite a significant fraction of the text/figures/tables are not "essential". In many places the text gives qualitative information (at best) but no quantitative information. I would suggest you read every paragraph in isolation and ask what did you learn, what does it say taht is new (post AR5). I'll have more specific comments below, but this applies mainly to Box SPM1 (some of these concelpts are not new); section A (largely qualitative, would fit in a textbook but not in a SPM) and section D. Likewise, global surface temperature is shown on 4 figures ! Are all these figures really needed. Carbon budget are reported in 2 tables (and numbers don't seem consistent), etc [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM and quantitative information has been included wherever possible.
41993	0				SPM is too long and would benefit from shortening. Some suggestions are presented in the detailed comments. [Juhani Damski, Finland]	Accepted. We significantly reduced the length of the revised version of the SPM.

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86539	0				IS there any chance section B and section C could be organised in a similar manner, having similar subsections in the same order: eg global energy, atmosphere, ocean, cryosphere, sea level change, extremes, etc... ? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The SPM has been completely reorganised and is not presenting the findings by the components of the climate system anymore.
86541	0				<p>I do not support the use of GSAT for reporting observed temperature in the SPM and the whole report. I understand the rationale (having a consistent global temperature metric for observations and model projections), but I think it is very risky change from previous assessments. GSAT is not directly observed. As described in chapter 2 (Cross chapter Box 2.3), GSAT can only be estimated by models. GSAT is estimated from observed GMST multiplied by a (potentially time varying) constant estimated from climate models. GSAT is higher than GMST (by 4% for current warming according to Cross-Chapter Box 2.3).</p> <p>I think there is a clear danger here, as IPCC will be seen as inflating/adjusting the observed temperature by 4% (inflating and adjusting are your words, I hope you realise how these words can easily be misinterpreted). While IPCC can try to explain that there is a good scientific rationale for doing this, it will undoubtedly be seen by some/many as cheating with data to make the story worse than it is. It will also be seen as calling observations a quantity that is NOT observed. Last but not least, it will mean that the global temperature reported by IPCC will not be consistent with the global temperature reported by GISS, NOAA, Hadley/CRU, etc. I urge you to reconsider this decision and to show and report GMST for observations. If consistency between past and future is your top priority, calculate GMST from the CMIP6 models. It's straightforward. An alternative would be to show GMST for observations (ex. figs SPM1, SPM2, SPM3 and SPM4, also consistent with maps on fig SPM5), and then to show both GSAT and GMST (for historical period) in Fig SPM7 and SPM10 when showed along future projections. Likewise when reporting numbers, all observed temperature changes should be based on GMST data (with GSAT estimate in bracket if you wish). [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]</p>	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
18707	0				"Table of Content is missing" [Govindasamy Bala, India]	Editorial but accepted.
44055	0				More focus on 1.5-compatible scenarios (SSP1-1.9) should be employed in the SPM in order to increase the policy-relevance of the SPM. Concrete instances where this could be done are for example the assessments of future sea-level changes in section C2. The SPM can also be improved in that respect by adding the envelope associated with SSP1-1.9 results in Figure SPM.7, as well as by adding information on this scenario in Figure SPM.9. [Lamin Mai Touray, Gambia]	Taken into account. We included more projection with the SSP1-1.9 scenario, as this information became more available from the literature. Note however that there remain a few instances where SSP1-1.9 is not used due to a lack of literature, e.g. HS9.1.
44057	0				Thanks a lot for providing such an informative Summary for Policymakers. We would nevertheless like to raise the point that it is already very long at this stage, and that we are afraid that this erodes its capacity to efficiently communicate the most important findings of the report to a non-expert audience of policymakers. We therefore ask the authors to please undertake efforts to limit the SPM to the most useful and policy-relevant information. Compared to the SPM of the AR5 WG1, it has very long tables which sometimes duplicate the information provided in the text, and very long statements. Please consider shortening these in order to bring the SPM to a suitable length. [Lamin Mai Touray, Gambia]	Accepted. We significantly reduced the length of the revised version of the SPM.

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103963	0				General SPM comment: This draft of the SPM is a good start to capturing the main messages of the report. In particular, most of the diagrams are very helpful. However, the SPM is too long - in particular Section A. A maximum of 25 pages (including figures) is recommended. Also, authors should ensure in each sub-section that the most policy-relevant findings are the most prominently placed: technical commentary about the state of the evidence should come later in the sub-section, and be kept to a minimum for the SPM. [Philippe Tulkens, Belgium]	Accepted. We significantly reduced the length of the revised version of the SPM.
103965	0				General comment on structure of sections The SPM would be more readable if each section, and its headline statement were to begin with the most policy-relevant findings, and then add the necessary caveats and justifications after. This may also help identify how much material is really needed to justify each statement, given the need to be concise. (see for example, comments on section A1) [Philippe Tulkens, Belgium]	Accepted. The revised SPM has a completely new structure where the logical flow has been improved. Additionally, the headline statements (in blue) have been shortened and simplified. They now focus on what is most policy-relevant and are fully supported by the bullet points, which provide more details.
80415	0				Biosphere processes are not clearly treated in the SPM [Paola Arias, Colombia]	Taken into account. HS1.8 now explicitly mentions the biosphere.
103967	0				The report refers to the frequency of events in some cases as return intervals (e.g., 100-year events) and in other cases with annual probability values (e.g., 1% probability). It would be useful to harmonise these and/or explain the reason for the different usage. [Philippe Tulkens, Belgium]	Accepted. We now refer to return interval (x-year event).
103969	0				'Biosphere' is addressed in chapters 3,2,5,8,10 and 11. A section dedicated to ecosystems should be included in the SPM. [Philippe Tulkens, Belgium]	Taken into account. HS1.8 now explicitly mentions the biosphere.
89895	0				1. The Summary is relatively good. The addition of the overarching highlighted conclusions which aims to provide a concise summary is a welcome improvement which already contains pertinent information. Further work however is needed to sharpen these conclusions to increase their focus and relevance to policymakers, so that they can have the impact envisaged. In general, the SPM needs further enrichment before the next session 2. Overall, the text of the SPM has quite a lot of technical detail which has made it particularly long. We recommend that the authors carefully consider what content is indispensable to the SPM and that which could be left in the underlying report, in order to shorten the SPM to a more reader-friendly size. [Joanne Deoraj, Trinidad and Tobago]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.
89897	0				There is also a need to strengthen the balance in this SPM with respect to impacts from different warming levels. It is our view that the SPM as it, represents a missed opportunity to draw together very pertinent information on how the science has improved with regard to the impacts at a warming level of 1.50C, since the SR1.5. This is a key interest to policymakers and it is very important that the IPCC demonstrate that it can bring together in an effective and concise way the most relevant information needed by policymakers on how the science has evolved over the two to seven years. We suggest the authors consider ways to incorporate the kind of messaging on a 1.50C warmer world that is consistent with information already contained in the underlying documents. [Joanne Deoraj, Trinidad and Tobago]	Taken into account. Providing assessment information across warming levels has been strengthened in the text and figures of the SPM. In addition, please refer to the first section of the Technical Summary for more detailed information on updates since the Special Report on 1.5°C Global Warming.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131627	0				The SMP is very technical, hiding a lot of its key findings and key messages behind technical terms; readers need a lot of background knowledge and the willingness to do their own web research to translate quite a few of the messages. It would be very helpful if guidance on how to read the tables and graphs would be given; especially when it comes to essential question like "How much time (carbon budget) is left?" [Hans Poertner and WGII TSU, Germany]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.
89899	0				The SPM insufficiently dealt with balancing the reporting on the various scenarios. For instance, there is limited to no information presented on SSP1-1.9 which is an important scenario for policy-makers. It is very important that the IPCC present relevant science as it relates to this scenario, some of which is already contained in the underlying report. [Joanne Deoraj, Trinidad and Tobago]	Taken into account. We included more projection with the SSP1-1.9 scenario, as this information became available from the literature published closer to the cut off deadline. Note however that there remain a few instances e.g. HS9.1 where SSP1-2.6 had to be used instead of SSP1-1.9, due to a lack of literature.
131629	0				The SPM author team is not well balanced in terms of country/region - with the main drafting author team is composed of authors coming to more than 80% from Developed Countries [Hans Poertner and WGII TSU, Germany]	Taken into account. The next drafting round of the SPM had contributions from authors from a wider range of countries.
41275	0				A huge thanks to the authors, Co-Chairs and TSU for their very hard work, congratulations on a very promising SPM draft! Page numbers of IPCC SPMs have been growing substantially over the years. This is not necessarily a positive development, I would argue. The current SPM draft is extremely long, also because it includes a whopping three (important) boxes. The longer the SPM, however, the harder it will be to produce lasting key messages. It would be much appreciated if the authors tried to considerably shorten the draft during the next review round. Section A, for example, appears to be the section that could be shortened the easiest. Hopefully, the authors will find the following more detailed comments useful. [Alexander Nauels, Germany]	Accepted. We significantly reduced the length of the revised version of the SPM.
41277	0				I assume that the authors envisage to streamline the figures/tables and sections visually. While it is totally understandable that the current draft does not deliver a consistent figure, table, section design, it should be established during the next review round. The SPM is very long and fractioned due to the boxes etc. Clear graphical guidance is needed to not lose the reader along the way. [Alexander Nauels, Germany]	Accepted. We significantly reduced the length of the revised version of the SPM. Additionally, Figures have been completely redrawn to provide a succinct, yet comprehensive set of figures, made by both designers and scientists.
41279	0				Multiple tables in this SPM draft are huge. The value of those tables will be extremely limited if the reader is not guided more proactively through the table maze with visual aids. [Alexander Nauels, Germany]	Accepted. The revised SPM only includes 2 short tables, which are much easier to read.
80465	0				The SPM is way too long (57 pag A4). Moreover, an SOD SPM normally gets longer when it becomes a FD SPM, This will likely lead to great difficulties at the line-by-line SPM approval session, and could lead to mayor deletions due to lack of time.. Especially whole section D is at risk as it is the last section and the subject 'limiting climate change' in a WG I SPM could be considered by some delegations as the task of WG III instead of WG I. A good standard would be a 30 pages 4 including figures, tables, maps and footnotes. It will be a mayor challenge to shorten this SPM while keeping its main policy relevant statements but it seems inevitable.. [Leo Meyer, Netherlands]	Accepted. We significantly reduced the length of the revised version of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
80467	0				The headline statements are a great invention of WG I AR5 team. These need to be understandable to policy makers, media and a broad audience. Taken together these could make a great 'summary of a summary' with the main key messages. However the headline statements in this SPM are often written in a too technical language. Process suggestion: I recommend to involve the communication experts of WG I (and perhaps those of the IPCC Secretariat as well) to working on these statements with the authors - the latter will have the last word of course. NB a pitfall in writing headline statements is the urge to summarize everything that is in a section, making an attempt to be comprehensive in just a few lines. This often leads to bland sentences that are both true and open doors ("truisms). Better to select salient statements from a section that are important to policy makers, if possible with quantitative information . AR5 WG I SPM gives great examples! [Leo Meyer, Netherlands]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report, which are then substantiated in the supporting bullets.
87891	0				The summary is much too long and parts are written most for scientists, not for policy makers. Ideally the SPM should be no more than 10-12 pages and ordered along the lines of the information that policy makers need rather than what the authors would like to say. Start with the most important messages, so focus should be on Chapter B and C. Suggested order B, C, A (much reduced) and D (also much reduced). The current SPM could be kept at this length in a "summary for scientists". Think in terms of what the characteristics are of the targeted policy makers, what will they use the SPM for and how will they use it. How much time will a policy-maker have to digest it and how will they use it? [John Carstensen, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM.
80469	0				The readers may not yet be familiar with SSPs.while an explanation in the SPM is lacking, and the description of SSPs in the Glossary is not a full explanation. More can be found in C 1 Cross chapter box 1.5 , but no description of the SSP narratives here either.A full explanation of the SSPs and its assumptions may be given in either WG II AR6 or WG III AR6 but that does not help here. I suggest to take up brief descriptions of the SSPs, and their narratives in the Glossary (could be done in a Box as well but that would make the SPM even longer.) . An example of short descriptions of the SSPs can be found in Box A7 from the FD SPM of SRCL I quote: " SSP1 is a pathway with low population growth (~7 billion in 2100), high income and reduced inequalities, effective land use regulation, less resource intensive consumption, including lower meat consumption and lower food waste, open trade and deployment of environmentally friendly technology. SSP2 is a pathway with medium population growth (~9 billion in 2100), medium income; technological progress and consumption patterns are a continuation of past trends, and only gradual improvement in inequality occurs. Compared to SSP 1 changes start later and are less effective. SSP3 is a pathway with high population (~13 billion in 2100), low income, material-intensive consumption, barriers to trade, and slow rates of technological change. The way in which the risks posed by climate change differ under each pathway" [Leo Meyer, Netherlands]	Taken into account. The 5 core SSPs are now introduced in Box 1 of the SPM. A Glossary entry into the concept of SSPs is also present.
87127	0				We believe that the SPM as it stands contains quite a bit of useful information however it is too lengthy for its intended audience. [Jacqueline Spence, Jamaica]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78937	0				Belgium called in IPCC plenay 46 for limiting the length of the SPM to no more than 10 pages, to ensure a clear and concise message, with Co-Chair Masson-Delmotte responding that flexibility is required for such a long report. She estimated 20-25 pages for the SPM, with 10 figures. Now the SPM is 57 pages. It is a summary of almost everything from the report, containing elements that are not essential for policymakers. We suggest to focus the SPM on the relevant and most important messages for the policy makers. [Martine Vanderstraeten, Belgium]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.
87129	0				In terms of the scenarios used in the report the one which we believe is in line with the Paris Agreement is the SSP1-1.9 however it is the scenario with the least available information for areas such as sea level rise. A lot more focus appears to be placed on SSP2-2.6 which is moving away from the Paris Agreement goal and therefore is problematic. We therefore ask for a more balanced approach in the treatment of the scenarios while keeping in the mind the Paris Agreement target of 1.5. [Jacqueline Spence, Jamaica]	Taken into account. We included more projection with the SSP1-1.9 scenario, as this information became available from the literature published closer to the cut off deadline. Note however that there remain a few instances e.g. HS9.1 where SSP1-2.6 had to be used instead of SSP1-1.9, due to a lack of literature.
78939	0				To make the SPM shorter we suggest to delete section A because it is not clear and because we do not understand the structure of A and B. Section A3 is interesting but we do not think that it fits in an SPM. Some parts of A could be integrated in B. [Martine Vanderstraeten, Belgium]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change the information from the SOD-section A has been integrated in the new SPM.
78941	0				It is of uppermost importance to express findings of this report in a way that is fully comparable with the assessment about the same topics in past reports. This is needed in particular for the UNFCCC, which made decisions such as the Paris Agreement on the basis of information provided in reports up to AR5. A key concern is the change in the determination of the global warming between the pre-industrial period and the period used as a starting point for future projections. The preference for GSAT should be justified, and other differences regarding its calculation for period starting in 1850 should be provided so as to explain why the GSAT warming for 2009-2018 is 1.1°C above 1850-1900 while the SR15 indicates that the GMST warming for a period centered around 2017 was 1.0°C above 1850-1900 (this is more than the 4% changes attributed to GMST/GSAT, so if other changes such as regarding incomplete coverage of observations play a role, this needs to be indicated in the SPM). Another important aspect of comparability is emission scenarios. RCPs were used in AR5 and are likely to remain highly relevant for the WGII assessment. Box SPM.2 indicates that RCPs and SSP/CMIP6 scenarios are directly related when they share the same forcing in 2100. However, it is known from papers such as www.geosci-model-dev.net/9/3461/2016/ that CMIP6 scenarios are not fully identical to RCPs at least because the forcing is different in the earlier decades. Please consider clarifying this and providing results for the RCPs when this can clarify how they differ from SSP-based scenarios. [Martine Vanderstraeten, Belgium]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. The relationship between SSPs and RCPs are explained in detail in Chapter 4 Section 4.6.2.2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34399	0				The SOD SPM -- at 57 pages -- is extremely long. Suggest shortening and moving about 40% of the material to the TS. [Haroon Kheshgi, United States of America]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.
39519	0				A relation between CO2 emissions and warming would be helpful for policy makers. There are about 3200 gigatons of CO2 in the atmosphere, then 873 gigatons of carbon (GtC). A doubling would increase the temperature by the TCR given in AR6, 1.8°C. The airborne fraction is 44 %. Emitting one ton of carbon, therefore, would increase temperature by $1/873,000,000,000 \times 0,44 \times 1.8^\circ\text{C}$, about 1 picodegree, a trillionth of degree C per ton of carbon. With this simple relation the addition of which is strongly recommended, each policy maker of a country, a region or a city may straightforwardly evaluate the impact on climate of his policy of emitting or avoiding emitting. [François Gervais, France]	Taken into account. The near-linear relationship between cumulative CO2 emissions and the global warming they cause is the topic of HS13.1 and figure SPM.10
32355	0				In several instances, it is mentioned that changes will continue "regardless of the emission scenario". Does this mean that changes would continue even if we stopped emissions completely now or does it mean that the changes will be happening no matter if we have lower or higher future emissions? This makes a difference to me because the former would imply that human action would be of no use, while the latter rather is a statement about the emergence of the signal. [Clemens Schwingshackl, Norway]	Taken into account. The revised SPM now clarifies what changes are committed due to the geophysical response (H.S.9). The detection of changes is now covered in HS.14. Committed changes across scenarios are shown in Figure SPM.8.
97125	0				In case information is provided for ocean and cryosphere and compared to previous reports, it should be made clear whether the results/numbers stated in the SPM are the same as in the SROCC or differ or whether they are based on new evidence / progress and thus confirmed. [Nicole Wilke, Germany]	Rejected. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters. The Technical Summary introduction section also covers key updates since the Special Report. This could not be included in the SPM due to space limitations.
97127	0				In the SPM of WG1 we are missing the figure "Radiative forcing by emissions and drivers", corresponding to figure SPM.2 in AR4 and figure SPM.5 in AR5. It is very often referred to and we think it would be beneficial to add this figure again, also for comparability to the previous ARs. However, please see also our comments on Fig. TS.25. [Nicole Wilke, Germany]	Rejected. radiative forcing bar charts can give a misleading picture of the contributions to historic warming. In an improvement over AR5, we are now able to calibrate emulators to the assessment, e.g. of ECS, to give a more complete assessment of historic warming from emissions. This is especially useful in the context of the SPM to provide a further line of evidence to attribution studies presented in Figure 2a.
97129	0				It is of key importance for the integrity and the credibility that the IPCC indicates qualitative levels of confidence or probabilistic, quantified measures of uncertainty in its statements. We noted that even for some important statements in the SPM, including some headline statements, there are no confidence statements provided. SPM-2-19 states that they are omitted "where appropriate". We cannot imagine any such case and strongly encourage the authors to supplement the text wherever possible and certainly for all key statements in the ES, TS, and the SPM with such information. [Nicole Wilke, Germany]	Rejected. Confidence terms do not need to be used is the assessment result is a statement of fact. This is stated in the guidance on the use of uncertainty language. We are purposefully avoiding the use of confidence statements in the headline statements when they are statements of fact. Note that all the supporting bullet do include uncertainty language where relevant.
97131	0				Please avoid the expression "deep uncertainty" in the SPM, or explain it very carefully to laypeople who are not familiar with this concept. [Nicole Wilke, Germany]	Taken into account. Term only used in footnote 20 of the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97133	0				Please explain what "climate model" means. The TS sometimes refers to GCM, sometimes to ESM, please clarify. [Nicole Wilke, Germany]	Taken into account. Reference to climate models in the SPM is now always with the context of CMIP.
97135	0				Please give numbers also to the preambles and headline statements. This will facilitate their citations. [Nicole Wilke, Germany]	Taken into account. Preambles are not called 'preambles' anymore but have become introductions to the sections. As such, we do not think it is needed to number them. The headline statements, on the other hand, are now numbered from HS1 to HS14.
97137	0				Statements on the persistence of observed trends need to include information on the availability of data, to avoid confusion of the persistence of the trend itself with the availability of observation of the trend, e.g. B.4.2, B5.1, table SPM.1. Please enhance the text in this regard. [Nicole Wilke, Germany]	Taken into account. Data availability limitations have been taken into account in the assessment. This has been made more traceable in the SPM such as in Figure SPM.3.
97139	0				The Atlas assesses approaches to communication. Especially these days, it is very important to communicate with everyone (the 'interested public'), so we would like to thank the authors for this information. However, if the Atlas does not relate to the policy relevant AR5-temperature scale, it will not be of much use. Please provide a function to convert from the AR6- to the AR5-scale. [Nicole Wilke, Germany]	Noted with thanks. Regarding the temperature scale: Not applicable. 1) Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
97141	0				The SPM focusses very much on temperature change and sea level rise plus related impacts. Precipitation and water cycle impacts, for example, are regarded as very uncertain. While this holds true for annual precipitation changes, seasonal precipitation changes (and related impacts) give quite robust signals which could be highlighted a bit more. [Nicole Wilke, Germany]	Taken into account. HS7 now focuses on projected changes in the water cycle
97143	0				The term "climate science" seems to be understood in this report (e.g. SPM-4-5, SPM-44-13,14) as limited to physical, biogeochemical aspect of climate. However, this is not appropriate since climate science addresses all aspects of climate including social, economical, cultural, ethical and philosophical aspects, which are all included in the IPCC process. Please use a clearer expression when referring to the scope of WG I, e.g. "physical climate science" as in the name of the WG. It is important to clarify that the contemporary IPCC has a broader understanding of climate science than in the past. [Nicole Wilke, Germany]	Taken into account. Term no longer mentioned in the revised SPM.
97145	0				There are many statements in this report linking the observed changes in temperature, CO2 concentration (as well as rate of change), surface pH values, Arctic ice loss, etc. to a timescale of millennia or even millions of years. Some statements have been included in the SPM, some are only in the TS or even in the chapters. We suggest to provide this long-term perspective of paleo data with high and very high confidence in one spot. Maybe as box or table in the beginning of B (maybe after the green box). These statements and data are very helpful to give an idea how unprecedented these changes are we observe already today. [Nicole Wilke, Germany]	Taken into account. HS2 relies on paleo-data to highlight the usualness of the current changes in pre-historical context. Paleodata that gives the longer term context is also found in Figure SPM.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97147	0				We suggest to add information on the difference in degsC between GSAT and GMST for today, for 2050, and for 2100, including the uncertainties, and to explain why the offset is not constant in Table SPM.1. Also, please check whether GSAT or GMST are used throughout the report, currently there is a mix. In addition, we suggest identifying an "AR5-temperature" that is equivalent to the temperature scale used in the AR5 and that is relevant for the Paris Agreement. [Nicole Wilke, Germany]	Taken into account Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM."
99963	0				The SPM is very useful and contains new information appreciate the effort from the authors for a comprehensive SPM. We do believe that despite this, the document appears to be a bit too lengthy We kindly recommend that the document be reduced to a size that is palatable to policy makers. Some suggestions include reducing on the number of tables and lengthy paragraphs. [Caroline Eugene, Saint Lucia]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.
97149	0				We would like to congratulate the author team on structure and form of this draft SPM. We particularly welcome the following aspects: - The themes and sequence of the sections, including the preambles helping to navigate the SPM. - The provision of headline statements. - The clarity and understandability of the language and the reduced use of scientific jargon: The science is presented in a way that is more comprehensible for laypersons than in previous reports. We provide comments to further improve the text. - Most of the figures are very useful as they convey clear messages and are easy to understand. We appreciate the description of the intended messages of the figures. - We suggest to increase the focus on the key messages and to streamline and shorten the SPM. - Section A providing background knowledge explaining why science is able to detect and attribute of climate change. This section might be a bit too long. - Section B linking the observations/detection of change together with attribution to causes of change. Table SPM.1 is very useful. - Section C synthesizing multiple lines of evidence, beyond scenario-based climate projections. We also support addressing low probability high impact events and the information at regional scale. Table SPM.2 is very useful. - Section D for the first time that a WG I report directly links highly relevant physical science information to mitigation and adaptation. In our review we provide detailed suggestions for further improvements of the SPM. [Nicole Wilke, Germany]	Noted with thanks.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
99965	0				The SPM lacks significant information on physical changes under SSP1-1.9. While general information is provided in Box SPM.2, the main focus is still on SSP2-2.6, despite not being fully Paris Agreement compatible. Grateful if the authors can impart SSP1-1.9 assessments of physical changes in the climate system wherever possible, and also in the figures. [Caroline Eugene, Saint Lucia]	Taken into account. We included more projection with the SSP1-1.9 scenario, as this information became available from the literature published closer to the cut off deadline. Note however that there remain a few instances e.g. HS9.1 where SSP1-2.6 had to be used instead of SSP1-1.9, due to a lack of literature.
130429	0				This size of SPM draft is too big. The text, figures, and boxes need to be condensed/reduced with the key messages more articulated. [Panmao Zhai, China]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.
130431	0				Preambles could be dropped since they do not reflect key messages. [Panmao Zhai, China]	Rejected. Preambles have been kept, as they introduce each section.
38275	0				<p>1. The SPM, which should summarize the key findings of all the chapters in the underlying report in a balanced manner, misses some important contents. For example, Part B does not fully reflect the assessment of the biosphere. Part D fails to keep a balance between the mitigation and adaptation, with no assessment conclusion for adaptation. It is suggested to fill these gaps.</p> <p>2. Some conclusions in the SPM are inaccurate and inconsistent with the underlying report, such as the impact of human activities on the climate system (SPM page 5 lines 22-24), the relationship between aerosols and the East Asian monsoon (SPM page 10 Lines 39-45). It is suggested to make modifications. In addition, the SPM should be consistent with the underlying report in terms of confidence language of assessment conclusions by section.</p> <p>3. There are too many pictures in the SPM, which are too complicated for policy-makers to capture the meaning. It is suggested to reduce the figures and make further modifications to improve its readability.</p> <p>4. The length of the current SPM far exceeds that stipulated by the IPCC Plenary Session. It is suggested to refine the language and compress the space. [Yaming LIU, China]</p>	<p>1. Taken into account. HS1.8 is now covering the biosphere. The 3rd section of the SPM (Climate Information for Risk Assessment and Regional Adaptation) now focuses on information relevant for adaptation while the 4th section (limiting climate change) is relevant for mitigation.</p> <p>2. Taken into account. We have checked the consistency of the SPM statements with that of the underlying chapters.</p> <p>3 and 4. Accepted. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.</p>
44675	0				The SPM should preferably be considerably more concise and ideally shorter. It should focus on outcomes, not methodologies, and in all cases be clear why the specific finding in question is included and its value-adding contribution to the overall storyline. The headline statements should also be short and to the point. Each specific finding should furthermore be as self-explanatory as possible. E.g., avoid stating only on there having been a "change" if the direction/nature of the change can be provided. If a statement of improved understanding is made, describe what the improvement entails. As an example: on page 10, lines 44-45, it is said that something has changed due to some "overall" effect, without any specification of why the effect has come about. (Changes in aerosols?) Another example: last sentence of B3.5 - what is the take-away for the reader? [Markku Rummukainen, Sweden]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience. Additionally, the headline statements have been shortened, streamlined and simplified.
44677	0				Please avoid less-than-clear references to projections, such as standalone use of "high warming" (unclear what is meant) or "higher levels of global warming" (this may be understood as referring to increasing global warming, or to a comparison between different scenarios) that is not readily clear - words such as "continued", "increased", "warming beyond 1.5 degrees" or suchlike could be explored instead. [Markku Rummukainen, Sweden]	Taken into account. Sentences have been rephrased to make it clearer to which scenarios statements are referring.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
84121	0				The draft SPM has numerous facts from newest scientific intelligence. And there are new approaches, e.g. use of GSAT instead of GSMT. [Manfred Treber, Germany]	noted.
105625	0				The SPM is the most critical chapter in the AR6. It is also the only chapter that is likely to be read by most people outside of the climate science community. It is, therefore, critical that this chapter be readable and understandable by lay persons. To that end, I suggest that the SPM be read and edited by several lay people, drawn from different backgrounds. I believe that the text can be obscure and difficult to understand by even intelligent people, if they are unfamiliar with the jargon of climate change. Figures should be included in this lay-person edit. [Julian Levy, United States of America]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
84123	0				But a policy maker who would read that would be lost in bringing these points together, a big view is missing on the situation and what has changed since AR5. [Manfred Treber, Germany]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
17565	0				There are only a couple of references in the text explaining how WGII or III may take forward and develop this information. There should be more. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This is done where relevant.
84125	0				Policy makers need to be aware of high-impact, low risk situations as well as "high impact" scenarios with "deep uncertainty." But this SPM framing of SLR does not provide that. [Manfred Treber, Germany]	Taken into account. HS12 specifically covers low likelihood high impact outcomes and footnote 20 defines the concept.
105629	0				I did not see the Executive Summary of the SPM. This is a critical element of the AR6, and should be available and subject to the SOD review. [Julian Levy, United States of America]	Rejected. There is no executive summary of the SPM, as it is meant as a summary document. Note however that the headline statements are meant as higher level summaries of the bullet points of each section.
17567	0				In the introduction, it states, 'This report builds upon' AR5, etc. While some key findings are provided in that context, with reference to these previous reports, it might be helpful if this is done more systematically (i.e. they confirm/reinforce a previous assessment or deviate from it (for good reason)). [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
84127	0				Please more explanation in SPM for working with GSAT instead of GSMT (e.g. like in Box TS.1) and influence on warming numbers, e.g. in SPM p2, l31ff -> 0.04 °C as in p24 l3 in TS.1 [Manfred Treber, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
105631	0				The AR6 does an excellent job of quantifying confidence with respect to those aspects of climate that have been studied. But, it fails to give a good perspective on those aspects of climate that have been inadequately or incompletely studied. Additionally, the SPM does not provide a clear picture of what areas of climate science deserve priority funding for further study. Therefore, within the SPM, I suggest adding a sub-section describing major areas requiring additional research and/or clarification. This sub-section would assist policymakers and the press in placing the overall conclusions of the AR6 into perspective. It would also assist policymakers in defining where future funding would do the most good in resolving outstanding climate change issues. [Julian Levy, United States of America]	Partially taken into account. The underlying chapters often contain sections that refer to areas of climate where assessments could not be reached due to limited evidence. Only the most policy relevant gaps feature in the SPM, for example, gaps in observations.
17569	0				The highlighted conclusions that, together, provide a concise (largely easy-to-assimilate) summary works well. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.
104353	0				It is important that changes expected to occur after the year 2100 are addressed. They are mentioned sometimes, but could be mentioned more often, and perhaps in a systematic way. I realize that uncertainties increase, but statements like "in this scenario temperatures are expected to increase also after 2100" could be useful. I think this is important to communicate that which CIDs will continue to change after 2100 in which scenarios. [Finnveden Göran, Sweden]	Taken into account. Sea level projections in 2300 are included in fig SPM.8 and HS9 is about long-term/irreversible changes
17571	0				Although I have raised some specific concerns about the figures, they are largely understandable and informative. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Figures have been improved.
98211	0				Thank you, the SPM provides a lot of new information compared to the AR5. [José Romero, Switzerland]	Noted with thanks.
104355	0				Potential thresholds/tipping points are important to address. Some are mentioned, but it would be useful if some more thresholds that are discussed in the literature could be addressed, even if the message is that it is not possible to address the probability that they will be passed. [Finnveden Göran, Sweden]	Taken into account: Thresholds and tipping points (of which there are many) are comprehensively addressed in the underlying chapters. To keep the SPM concise, we refer not to any specific examples in the text.
17573	0				The structure works. It flows well. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
98213	0				Throughout the MPS it should be clearly stated what scientific progress has been made since the AR5 in understanding climate processes and detecting and attributing anthropogenic influences. [José Romero, Switzerland]	Taken into account. Attribution advances are clearly stated in the revised HS.3 section.
104357	0				There are some feedbacks that are not included in current models. There are also some potential threshold that are not addressed in the SPM. This means that there is a risk for negative surprises in the sense that the situation is more severe than we realize with current knowledge. It would be good if this could be addressed in the SPM. Is there a risk for negative surprises? [Finnveden Göran, Sweden]	Taken into account: The whole existence of the section HS12 is to highlight that there could be(negative) surprises beyond the likely range assessed in other sections. We sharpened the language to make this more clear.
98215	0				The SPM is too long. [José Romero, Switzerland]	Accepted. We significantly reduced the length of the revised version of the SPM.
98217	0				Section A is interesting, but it is questionable whether it is appropriate to have it in the SPM.It contains little quantitative material and presents a discussion of general concepts and historical developments that are, admittedly, useful to the reader, but it does not focus on the new information and updated knowledge that is expected in an SPM of any new IPCC assessment report. Therefore, would it be possible to consider deleting Section A and distributing the few relevant quantitative elements from Section A in the other sections? Furthermore, since the SPM is already quite long, without Section A it would be shorter and easier to read. [José Romero, Switzerland]	Accepted. Section A was removed and the key information distributed in other sections.
98219	0				A number of expressions are used in the SPM to refer to temperature increase: "global mean temperature", "global warming", "GSAT", "anomaly", "global average surface air temperature", "global surface air temperature warming level of", etc. Do they have the same meaning? Would it be possible to use the same expression when referring to temperature increase? [José Romero, Switzerland]	Taken into account. Now 'global surface temperature' is used consistently. "Anomaly" only features in the technical caption of some figures. "Global warming level" is used for specific warming levels such as +1.5°C, 2°C or 4°C of warming compared to 1850–1900. This concept is used to assess and communicate information about global and regional changes, impacts, and emissions and concentration scenarios.
98221	0				Section B.1 is confusing as regards emission sources and emitting sectors: it does not consistently present emissions in AFOLU and each one of its components (forestry, land use and land-use change). [José Romero, Switzerland]	Taken into account. The FGD SPM has been restructured, refocused and streamlined. Emission sources and emitting sectors are no longer mixed in the same bullet point. AFOLU is not used in the WGI FGD SPM, this term is more commonly used in the WGIII report.
98223	0				The use of the adjective "effective" in the expression "effective radiative forcing" is problematic. Indeed, in the Glossary, the definition of "effective radiative forcing" refers to that of "radiative forcing" and, again in the Glossary, "effective radiative forcing" is used only in relation to the radiative forcing of aerosols and clouds. [José Romero, Switzerland]	Taken into account. "effective radiative forcing" no longer appears in the SPM and we have also tried to avoid the term 'radiative forcing' wherever possible.
104367	0				It is very useful if figures can be used in a Powerpoint presentation for example by a teacher in higher education. If that is possible, the dissemination of the material will increase. [Finnveden Göran, Sweden]	Noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68785	0				The SPM contains a lot of very useful new information. While we appreciate the attempt by the author team to provide a comprehensive SPM, it is too long and can be very discouraging to read. Section A, huge tables, and very long individual paragraphs are just a couple of examples where this SPM could be shortened. [Jeffers Cheryl , Saint Kitts and Nevis]	Accepted. We significantly reduced the length of the revised version of the SPM.
68787	0				The SPM lacks information on physical changes under SSP1-1.9. too much focus is still on SSP2-2.6, despite not being fully Paris Agreement compatible. It would be good to see SSP1-19 assessments of physical changes in the climate system wherever possible, also in the figures [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. SSP1-1.9 was assessed whenever possible. However, it is not always possible to due a lack of literature covering it.
108993	0				Readers/policymakers might be confused or unclear on the distinction or link between extremes and climate impact drivers. Perhaps it needs to be better articulated (e.g. in box spm.1 or in the specific subsections). There is Table SPM.2, for example, that is on projected changes in extremes but when moving to regional changes, the synthesis "suddenly" shifts to climate impact drivers. [Gemma Teresa Narisma, Philippines]	Accepted. Text, captions etc clarified to note that CIDs include extremes.
67789	0				Information on what is considered new risks and uncertainties related to climate change in AR6 should be clearly outlined, as those will affect what kind of response policies needed from parties. [Ruandha Agung Sugardiman, Indonesia]	Taken into account. The 3rd section of the revised SPM is now focusing on Climate Information for Risk Assessment and Regional Adaptation and contains a headline statement specifically focusing on low-likelihood high impacts outcomes (HS12). Note however that risks and impacts are assessed by WGII.
67791	0				In this climate change context, risk does not always refer to uncertainty. Very high certainty can still poses a risk. It may be more useful to emphasize that risk is a potential; it need not occur if appropriate policies and measures can be applied to reduce the potential or the consequences. [Ruandha Agung Sugardiman, Indonesia]	Taken into account. The 3rd section of the revised SPM is now focusing on Climate Information for Risk Assessment and Regional Adaptation and contains a headline statement specifically focusing on low-likelihood high impacts outcomes (HS12). Note however that risks and impacts are assessed by WGII.
67793	0				A common framework for describing and assessing risk across the working groups is adopted to promote clear and consistent communication of risks and to better inform risk assessment and decision making related to climate change. In general, the chapter does not concern uncertainty and risk per se but decision making. [Ruandha Agung Sugardiman, Indonesia]	Noted.
67795	0				Confidence is a qualitative measure of the validity of a finding, and is expressed using five qualifiers: very low, low, medium, high, and very high, and, where possible, probabilistically with a quantified likelihood. The concept of threshold level should be clearly defined. [Ruandha Agung Sugardiman, Indonesia]	Noted.
67797	0				Probabilistic estimates of quantified measures of uncertainty in a finding are based on statistical analysis of observations or model results, or both, and expert judgment. There are also findings that are formulated as statements of fact without using uncertainty qualifiers. [Ruandha Agung Sugardiman, Indonesia]	Noted.
67799	0				Throughout the WGI report and unless stated otherwise, uncertainty is quantified using 90% uncertainty intervals. The 90% uncertainty interval, is expected to have a 90% likelihood of covering the value that is being estimated. There are several other sources of uncertainties, e.g. effects of policies that need to be elaborated. [Ruandha Agung Sugardiman, Indonesia]	Noted.

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67801	0				These are events whose probability is low but whose potential impacts on society and ecosystems are high. To better inform risk assessment and decision making, such low likelihood outcomes are described as they may be associated with very high levels of risk and because the greatest risks might not be associated with the most likely outcome. [Ruandha Agung Sugardiman, Indonesia]	Noted.
107993	0				SPM is already very good and has made great steps forward for clear communication in terms of how figures are constructed and in terms of how the text is structured and expressed. It's in a very good position for moving forwards to the final government draft. Well done to the writing team and TSU. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.
67803	0				What would be particularly useful for the readers is to provide examples where the different decision-making frameworks are applied by the various types of actors and what the outcomes have been. [Ruandha Agung Sugardiman, Indonesia]	Rejected. This is beyond the mandate of the WGI. Policy frameworks may be covered in the WGII and WGIII reports.
67805	0				More elaboration by differentiating more specific choice types and the impact of uncertainty on the timing of choices/actions is needed. Where relevant, links to related key findings from WG I and other WGs could be established. [Ruandha Agung Sugardiman, Indonesia]	Rejected. This is beyond the mandate of the WGI. Choices of actions may be covered in the WGII and WGIII reports.
40925	0				The fact that negative emissions are not equal and opposite to positive emissions and have a lot of side effects, which is to me an important conclusion of chapter 5, seems to be absent from the SPM. [TSU WGI, France]	Taken into account. This is now addressed in HS13 in the final SPM.
67807	0				Overall, this is a good comprehensive report which takes a more interdisciplinary, physical and behavioral approach to understanding risk, although not all response to risk can be modelled. [Ruandha Agung Sugardiman, Indonesia]	Noted with thanks.
40929	0				The fact that there seem to be "no tipping point for the loss of Arctic summer sea ice" , which is to me an important conclusion of chapter 9, seems to be absent from the SPM. [TSU WGI, France]	Taken into account tipping point and projected Arctic sea ice extent is now covered in H.S.9, HS.12 and Figure SPM.8.
28135	0				The purpose of this report is to summarize the main results of the analyses, focusing on the new features compared to the AR5. We feel that this part is of very high quality in terms of content and structure and we have not identified any critical missing type of information. [Eric Brun, France]	Noted with thanks.
28137	0				The length of the SPM is far too long in order to be striking and entirely read by people it is dedicated to. Though the series of overarching highlighted conclusions are intended to provide a concise summary, some sentences need to be deleted. 30 pages, including Figures, should be the upper limit for any SPM draft ahead of an approval session. There are several possibilities for shorten the SPM SOD, in particular through a strong reduction of Section A, a deletion of either Table 1 or Figure 1 in Box SPM.3, the deletion of a great number of messages which have no significant value for decision-makers. [Eric Brun, France]	Accepted. We significantly reduced the length of the revised version of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
64745	0				There is no clear statement in the SPM on the attribution to human activities of the global mean surface temperature change to date from the preindustrial period or from the mid-20th century. The main statement at the beginning of section A.1 concerns the climate system as a whole and is presented as an human influence without any specific reference to GSAT. Estimates of GSAT change from observations and models are given in section B1.2 and they are represented in Figure SPM.10, but without explicit reference to an attribution statement. The clear statement of chapter 3 executive summary (page 4, lines 18-19) could be added in the SPM : « it is extremely likely that human influence is the main driver of the observed warming ». [Serge PLANTON, France]	Taken into account. Addressed in the HS1.2
28139	0				There are a significant number of sentences which convey important findings for climate scientists or which provide the scientific rationale behind some results. Considering the excessive length of the SPM, we suggest to delete these messages and to limit the SPM to the main findings of interest for policy-makers. The best place for these messages is in the Technical Summary. [Eric Brun, France]	Accepted. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
28141	0				Some of the paragraphs are still complex to read and should be simplified to reach a wider audience, and make sure the reader understands how the key message have been constructed from the different elements discussed in the different Chapters. [Eric Brun, France]	Accepted. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
101613	0				I focus my SOD review solely on the Summary for Policy Makers as health conditions over the past 8 months (2 cardiac and 2 abdominal surgeries) limited time available. Overall, the SPM is well organized and scientifically sound. It clearly describes and summarizes the states of knowledge of key issues that policy makers must address in the near and long terms. My specific comments are nearly all editorial in nature, and I hope they are of use. One key omission is that of an Executive Summary. I strongly recommend developing a 1 to 1 page section that clearly highlights the overall messages of the SPM. Thanks for inviting my comments. [Knut Nadelhoffer, United States of America]	Taken into account. The headline statements have been shortened and sharpened. Taken together they provide a high-level and accessible summary of the SPM.
28143	0				Using different reference periods to express projections in the SPM (i.e. 1995-2014 and 1850-1900) is a source of confusion. We strongly recommend to use 1850-1900 as the unique reference period to express projections in the messages. However, both reference periods can be used altogether in some of the figures such as in Figure SPM.7. [Eric Brun, France]	Taken into account. The main reference period is now 1850-1900. It is used whenever possible but there are some cases (e.g. sea level) for which this baseline does not work because the data are not robust enough.

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28145	0				A particular attention should be put on the way the warming rate and intervals are defined and communicated. Different lines of evidence are involved, which is new and interesting, but should be better traced back in the document. Each assumption should be clearly explained. In particular, new and more robust estimates of climate sensitivity are now available, but for most of them they are still indirect estimates, and there is a risk to be overconfident. The low sensitivity values seem to be better defined, but there are still difficulties to properly estimate the high one, and more consideration should be brought to the high tail of the distribution, that has low probability, but potentially high associated risk. [Eric Brun, France]	Taken into account. Greater traceability to the TS and the underlying chapters have been introduced in the FGD. There is now a cross-section box in the TS on Global Surface Temperature Change and a Cross-Chapter Box 11.1 that focuses on the translation of global warming levels and scenario data.
28147	0				As explained in Box SPM.1, the difference between GMST and GSAT is a major concept. The authors choose to use GSAT instead of GMST, yet in the report GMST is often used, as well as “global mean surface atmospheric temperature”. The wide use of GMST in the SPM is disturbing since it seems in deep contradiction with the content of Box SPM.1. The nomenclature should be unified in order to respect this choice. [Eric Brun, France]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
28149	0				Regarding some of the SPM messages, France has a major concern with the current division of Europe into geographic domains, especially for the Central Europe domain. Indeed, the current “Central Europe” covers a domain with completely different climates. We strongly recommend to choose a new division which makes it possible to separate the Western part of Europe, which has a maritime climate, from the Eastern part which has a continental climate. If it is not the case, all Tables and messages in the vol1 SPM, TS and Chapters referring to the current "Central Europe" would be completely meaningless and useless for France. We recommend to adopt for the Atlas the division mentioned in the first paragraph of 12.4.5. [Eric Brun, France]	Rejected. In terms of the climate of the region there is a transition from a more maritime to a more continental climate but there is no clear boundary separating two sub-regions with completely different climate. Also, there are north-south gradients which need representing in the reference regions, and this region is a transition region from a clear signal of projected precipitation decrease to the south and increase to the north. Further decomposition to include all of these details and other relevant details would result in regions too small to be adequately resolved in GCMs. Note that the name of the Central European region is changed to Western and Central Europe to clarify the parts that it encompasses.

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28151	0				The procedure of inferring GSAT projections from models and other lines of evidence is a bit obscure. We would recommend the authors to check again. GSAT projections from models with ECS/TCR in the very likely range should fall within the very likely range of the corrected projections. We suspect this is not the case for the low-end scenarios. [Eric Brun, France]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
28153	0				The manner in which impacts of climate change are described is not very balanced. Some are mentioned (such as sea-level rise or hot days and nights), while others are missing (e.g. high tides). In paragraph C.5.2, only the impacts of heat stress on "health, agriculture and other sectors" is mentioned. It would be relevant to harmonize. Paragraph C.4 is very clear and well underlines interlinks between future changes of the water cycle, soil quality, and vegetation productivity. However, it could insist more directly on impact on water availability, and the growing water scarcity as a consequence of these changes. [Eric Brun, France]	Taken into account. HS.7 now focuses on climate changes to the water cycle but note that some impacts statements requested go beyond the WGI mandate.
111609	0				Congratulations to the drafting team on producing a really engaging draft that shows several areas of real progress since AR5. I have submitted a number of general and specific comments and suggestions below. An overall comment is that the draft is pitched at a level that, as a working scientist, I found extremely valuable in summarising progress across the remit of WGI. I did wonder whether it was maybe a bit too long for policymakers' use? It needs to be short enough that a busy user is not put off reading it. Given that it is only likely to get longer through the review and plenary process it may be worth considering carefully which parts are truly policy relevant rather than 'just' scientifically interesting. For example there is a fair amount of tutorial material at the beginning. I wonder whether Section A could be shortened substantially. Do the policy users really need this? Some of the messages also came across as quite complex and hard to see how they could inform policy - I've flagged some of these. Obviously there will be a range of views on this, including from governments, which will help pitch it at the right level. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.
78587	0				I read the SPM with great interest – the authors are to be congratulated on a fascinating and comprehensive document. My concern though is that – at 57 pages – it is both too long and too technically complex for an SPM. I have made a few suggestions of parts to shorten and simplify – some of it sits more comfortably in the TS. I do fear that if this was published in this form there would be calls from government departments for climate scientists to write a summary-of-the-summary. My comments may make more sense if taken together – I'm aware they will be split up within a long list of comments. I've tried to keep each comment self-contained, but please take them all the context that this is a great document – just too long/complex for an SPM (IMHO). [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28155	0				Impacts and negative feedbacks are not well explained. For instance, there's nothing in section D that talks about adverse feedbacks of SRM and CDR to biogeochemistry and organisms, whereas in Chapter 5 this is very well analysed and shown even with summary tables: Section 5.6, Figure 5.6, Box 5.2. We stress the importance of this issue in the context of the societal debate on geo-engineering. [Eric Brun, France]	Taken into account. While SRM is no longer mentioned in the revised SPM, HS13.4 on CDR includes a footnote about the side effects of CDR techniques.
111611	0				A general comment on the figures. There are two conflicting drivers. Many of the figures attempt to provide a 'one stop shop' to summarise a particular issue (e.g. Figs SPM.3, 4, 7, 8, Box 2 Fig.1). This is very useful when trying to summarise the key points of complex issues. However such figures are difficult to use for the kind of really quick communication that says, e.g. 'future emissions pathways make a big difference to future climate', for which some stripped down, simplified figures are needed. There are definitely pulls in opposite directions here. Maybe there is value in including a few such simplified figures, either as extra panels to the existing figures or as an annex to the SPM? [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. In the revised SPM, the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Additionally, each figure includes a very clear intent that is written down and that is visually shown by the figure itself. Each figure has also been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers.
78589	0				It might be useful to have a clearly signposted structure up front – a bit like is being done for individual chapters. A: Understanding; B. Current state; C. Futures; D. Response. Within each heading it would be great if each section could be kept to one page of text – especially if it started on a new page and so each section really looks like a 1-page summary. A1 Global; A2 Regional; A3 impacts – 1 page each. You get the picture. Suggest total length could be limited as: A (3 pages): Global, Regional, Impacts. B (5 pages): Energy budget, Atmosphere, Ocean, Cryosphere, Extremes. C (try to keep to 4-5 pages): Warming levels, ocean/cryosphere, circulation/water cycle (try to combine these – see comment below), extremes. D (4 pages): Limiting; CDR; SRM; Detecting impact; societal information. For example I could pick out section B3 as a good example – it has clear single key conclusions – put in 1 paragraph each, and keeps to 1 page. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised version includes a table of content and is much shorter than before.
28157	0				The findings on hydrology in the Chapters, and in particular on the water cycle, are not sufficiently reflected in the SPM. It includes the information on how the changes in the river discharges impact the global ocean and regional seas. [Eric Brun, France]	Noted. Information on hydrology have been re-organized in the SPM. Choices have been made in terms of the most policy relevant points to maintain.
111613	0				Since AR5 there is increased emphasis on presenting some climate change information as changes at a given level of global warming (rather than at a given time, contingent on some emissions scenario). This is valuable and reasonable for some variables but not for others, especially as the world considers real mitigation pathways to particular global temperature targets, including overshoots. I was very pleased to see that for some variables there is an explicit statement that changes do or do not scale with global warming, but this is a little patchy across the SPM. Because of the increased policy emphasis on how the world can achieve global temperature targets, it is increasingly important that users have clear information on what does or doesn't scale with global warming, or under what scenarios it scales (e.g. only for scenarios of constantly increasing GHG concentration). I think it would be very valuable to collect this information together in one place in the SPM (maybe a short box) so it was easy to find. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Timescales of response are now covered in HS9. Additionally, in the underlying report, there is now a Cross-Chapter Box 11.1 that focuses on the translation of global warming levels and scenario data.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7679	0				The length of the SPM is probably a new record. However, this has two problems: first it is very challenging to approve line by line such a long document and second it is unlikely that the policy makers will be willing to read such a long document. The longer the SPM the less influential it might be. The Technical Summary is only 4 times longer - it is strongly recommended to shorten the SPM - it would be very helpful to have finally only 25 pages. [Klaus Radunsky, Austria]	Accepted. We significantly reduced the length of the revised version of the SPM.
78591	0				In keeping with my comments that this SPM is too complex – some of this was based on my first reaction at reading it. I felt overwhelmed by the complexity and depth of information in the display items. The text largely is good (although could still be shortened). But many of the tables and figures would require an entire lecture series to explain fully. Again – they’re really nice for a science audience and fit the TS well, but don’t feel suited to SPM. Specific comments below address them in turn. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience. Furthermore, we have reduced the number of figure and figures.
111615	0				Another very welcome statement in the SPM is the recognition of the importance of low probability, high impact (LPHI) events in the overall profile of climate-related risk. This is recognised in Box SPM.1, along with the value of the storyline approach in addressing such issues. However the actual coverage of LPHI events seems quite thin in the SPM. Instead, virtually all the current draft SPM focuses on likely ranges. Even the section C.6 on LPHI events doesn't really include any substantive storylines, and focuses instead on likelihood statements. This seems to me a lost opportunity or worse - while I appreciate that it's important to discuss the most likely outcomes, it is also important to alert policy makers to the possible LPHI (potentially high risk) events and what climate science can tell us about them - while avoiding alarmism. This is a real challenge but it's the sort of challenge that IPCC was set up to tackle. We are currently living through a major global (non-climate-related) event that shows the value of societal preparedness for anticipatable events, and the same message on preparedness is surely true for climate. I accept that this is a direction of travel, AR6 reflects the current state of scientific progress, but I think more could be done here based on current knowledge. Indeed there is some good material on this in the TS (e.g. boxes TS.2,3,4), but I think it's really important that this is brought through to the SPM so that the SPM gives a complete picture of the risk profile associated with climate change. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: The section has been revised to emphasis more statements that are beyond the likely range (HS12.1).
86047	1	0	57	0	Entire SPM: the language is unnecessarily technical in many places, and every effort should be made to simplify it without losing scientific accuracy. Recommend using active voice and direct verbs (as opposed to verb-nouns) throughout, for improved readability. [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make this document more accessible to a policy-maker audience.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86049	1	0	57	0	It is highly recommended that communication specialists help shaping the wording of the SPM, to make it accessible to a wider policy audience, as per intention stated in A.3.3. [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible (in collaboration with communication experts). Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
86051	1	0	57	0	Unhelpful acronyms for the SPM include ERF, SLRF, GSAT, TC, ECS, TCR, TCRE, and others. Please remove all acronyms that are not very common from the Summary for Policy makers. [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted. We have reduced the number of acronyms used to a strict minimum.
86053	1	0	57	0	All figures and tables: spell out all acronyms. The light blue dots in the right panel are not visible enough. Use a different colour range, where zero is not white, e.g. consider using brown for drying and green for wetting, and yellow for zero, which is more intuitive. Red-blue suggests hot-cold. In the left panel avoid black colour region borders that get confused with the land boundaries, rather do it as in Fig 8 [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. The figure have been substantially revised through a co-design process between the authors, graphics designers and the TSU. The number of tables has also significantly decreased
86055	1	0	57	0	Besides mentioning that the report is informed by the three SRs, there is no other reference to the SRCCL. Land-related findings in the SPM should be supported with SRCCL where appropriate. A2 is a good candidate. The entire SPM will benefit from more references to the previous SR SPMs [Debra Roberts and the Durban WGII TSU, South Africa]	Rejected. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
41219	1	1	1	1	Given where we are in the WG1 cycle, this is an excellent draft of the SPM. Great work and thank you all [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.
112179	1	1	1	1	SPM has a good structure to it. It already acquiring an organized look, with the Sections A-D already quite polished in their construction. The Sections carry the major points of this Assessment. In my view, the SPM is running to approximately the optimal length, maybe slightly lengthy. Table SPM 1 and 2 look good and will get lots of attention. Illustrations are off to a very good start. [venkatachalam ramaswamy, United States of America]	Noted with thanks but have shortened and reorganised the SPM to address other comments.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66713	1	1	1	1	<p>Material on emissions metrics is not in this SPM - I think there was supposed to be an Exec Summ point elevated into the SPM. English Bill Collins and I have suggested some text, which could go in amongst the rest of the Chapter 7 material. Text reads: "Emissions metrics are useful for comparing the relative effects of different greenhouse gases, for example comparing the relative contributions of mitigation towards a climate policy target. AR5 discussed emission metrics such as GWP and GTP that compare the relative effects of pulse emissions of non-CO2 gases against CO2.</p> <p>Since AR5, alternative methods for comparing the warming effects of greenhouse gases have been developed. Step-pulse emissions metrics (e.g. GWP* and CGTP) compare the effects of a sustained step change in emissions of short-lived species like methane against a pulse emission of CO2. These give a more faithful simulation of the temperature effects of a portfolio of gases, especially under mitigation scenarios, such as those implied by successful attainment of the temperature goals set out in Article 2 of the Paris Agreement {7.6.3}." [Dave Frame, New Zealand]</p>	Taken into account. Emission metrics are covered in HS13.7
12621	1	1	1	30	The author list of SPM is heavily UK/France/U.S dominated, there are 23 authors from these three countries within a total of 44 authors, Asian/Africa are poorly represented. [Lijing Cheng, China]	Taken into account. The next drafting round of the SPM had contributions from authors from a wider range of countries.
93601	1	1	57	1	The number of statements made with a low level of confidence seems high for a SPM. This is particularly the case for Table SPM.1. Statements with a low level of confidence should be limited and have a very good reason for being there. [Jean-Louis Dufresne, France]	Taken into account. Table SPM.1 was removed from revised SPM but the amount of low confidence statements has been greatly reduced.
117217	1	1	57	1	Overall it would be important which observed, and projected changes are irreversible and which not. Including time-scales. [Maisa Rojas, Chile]	Accepted. HS8 now covers irreversibility.
83365	1	1	57	12	General comment - The Summary for Policymakers is mainly focussed on the Northern Hemisphere. Please look closely at redressing the balance re change etc. in the Southern Hemisphere and Antarctica. [Robert Massom, Australia]	Taken into account. Efforts have been made to increase the regional diversity of the SPM. For example in HS7, HS11 and in figures SPM.3 and SPM.9.
76867	1	1	57	20	Excellent work done on this report. However, text is highly technical & scientific in places and more akin to a Technical Summary [Emer Griffin, Ireland]	Taken into account. Revised version is simpler and more accessible to a wide audience.
76869	1	1	57	20	The text is quite long and can be shorter, simpler and cleared for a non-scientific audience. [Emer Griffin, Ireland]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.
109509	1	1	57	22	There are many instances of the SPM using the term "emissions scenario" when presenting projections from climate models driven by CO2 concentrations. I think this risks allowing readers to not appreciate the important difference between the two quantities. Any single emissions scenario can result in a range of concentration pathways, and similarly, any single concentration pathway can result from a range of emissions scenarios, because carbon cycle feedbacks are not perfectly constrained. RCP8.5, for example, could arise from a less high emissions trajectory if carbon cycle feedbacks are stronger than in the models used to produce the standard emissions-concentration relationships. Also, readers need to understand that even when CO2 emissions start to decline, CO2 concentrations continue to rise (as happened in early 2020, and as seen in the strong mitigation SSPs). [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Chapter 4 develops the differences between emission and concentration driver scenarios in Section 4.2.1. Additionally, the relative magnitude of CO2 emissions in each SSP has been clarified in the FGD SPM. The timescale of response of CO2 emissions vs concentrations vs temperature change is covered in HS14.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
74015	1	1	57	57	In all the report and various sections, the data for all parameters are displayed on a yearly calendar (Gregorian) basis. A proper presentation of the data should have been done on a hydrological yearly segregation, since in calendar years usually the winter season is split in two consecutive years, using perhaps related, same winter events, as separate independent events in the statistics. [Sergiu Dov ROSEN, Israel]	Rejected. Presenting time series in calendar years is following past IPCC practices.
36009	1	1			A very well written SPM. It is clear that a lot of work has gone into this since the ZOD version. [Michael PRATHER, United States of America]	Noted with thanks.
36011	1	1			A plea for better, clearer typesetting of the SPM. In recent AR, the extra fancy formatting (pink boxes with brownish fonts) has obscured the key headline messages. Everyone must realize that these shaded boxes are actually harder to read, and when printed B&W, they are truly muddy. Can I encourage you to break with the previous IPCC 'leadership' and bring back black type on a white background. You know what highlighting does to on-screen documents (it does not make the text easier to read). I would suggest that boxes be placed around the headlines, the boxes can be colored, shadowed or anything to get attention. Also if you shorten the headlines (as I think you should here), then use 14 pt type. While confidence language should be in the headlines, there is no need for chapter traceability as this information should be in the bullets below. [Michael PRATHER, United States of America]	Taken into account. In the revised the SPM, the headline statements are highlighted with a blue bold font and the section introduction are shown in italics. Note however that layout of the SPM drafts are only temporary as the finally version goes through professional copy-editing and lay outing prior to publication.
66697	1	4	1	16	Of the 45 Drafting Authors, those with a seat at the table for the framing of the most policy-relevant part of this report, 26 are from Western Europe. That is a clear numerical majority for a region representing less than 3% of the global population. There are four authors from the entire Southern Hemisphere (14% of global population), two from Africa (18% of global population) and, most glaringly, three authors from Asia (62% of the global population). [Dave Frame, New Zealand]	Taken into account. The next drafting round of the SPM had contributions from authors from a wider range of countries.
101495	1	4			Change "based on the assessment of" to "based on assessments of" [Knute Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
129693	1	31	1	34	[GSAT] In Box SPM.1, the difference between GSAT and GMST is not clear. It needs a better definition. [Trigg Talley, United States of America]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. (Note that box spm.1 has disappeared from the revised SPM)
77555	1	31			0.19m GMSL rise is stated in bullet B3.2 while 18cm is used in the figure caption for SPM.1 on page 7, should be corrected to ensure consistency [Emer Griffin, Ireland]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86057	1		57	0	More information about droughts and drying and drylands in C4 would be welcome. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Drought-related information is shown in Figures SPM.3c, SPM.5d SPM.6d, SPM.9. (which is 4 figures out of 10).
84853	1		57		Austrian Government Comment to the SOD of WG1 SPM. This is a general comment on the entire SPM. The goal is to improve the report as a whole, which is urgently necessary from Austria's point of view. The text is far too long. 57 pages exceeds any reasonable measure in which an SPM should move. The language used is too complex, some of the sentences are too long. It should be borne in mind that many PM have a non-UN language as their mother tongue. A concrete example is the second sentence of paragraph A.2.3. The figures are partly too complicated and overloaded with information that is not important or understandable for PM (example: Figure SPM.1: GMST from HadCRUT5, GMST from PAGES2k). Reading the draft gives the impression that the authors have tried to accommodate as much information as possible. The consequence is a drastic reduction in reading friendliness, especially for PM, who in many cases are not specialists in these fields. The text should be written for these people. When key IPCC texts are no longer easy to read, the interest of policymakers also diminishes, because the impression arises that the addressees are other scientists. [Manfred Ogris, Austria]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a policy-maker audience.
84855	1		57		Proposal for a way forward: The SPM should only consist of the headline statements of the draft. These should be written in such a way that they are understandable without having to read the current paragraphs below. The figures and tables should aim to better understand and remember the information in the headline statements. They should not aim to place as much additional information as possible in as little space as possible. An SPM is not a TS for PM. Although the IPCC might well consider producing such a TS for PM. This text could contain all the information that is removed from the current SPM. This would reduce the pressure to bring a lot of information into the SPM [Manfred Ogris, Austria]	Taken into account. The headline statements have been shortened and sharpened. Taken together they provide a high-level and accessible summary of the SPM. We significantly reduced the length of the revised SPM and tried to simplify the language wherever possible (in collaboration with communication experts). Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
8583	1		57		Some very good things here including introductory explanations of figures; frequent comparisons with AR5; coverage of extremes; coverage of low-likelihood, high impact events [Jonathan Lynn, Switzerland]	Noted with thanks.
8585	1		57		where uncertainties are highlighted (eg table 3) be prepared to defend inclusion as policy-relevant during approval session (eg points to low-likelihood high-impact events) [Jonathan Lynn, Switzerland]	noted
8587	1		57		know you will copy-edit but please include standardization of hyphenation for adjectives and adjectival phrases e.g. "this event has a high impact" (no hyphen) vs "this is a high-impact event" (hyphen because a compound adjective is formed of an adjective and a noun); and certain compound nouns e.g. "decision-making" because it makes a new compound noun out of a noun and verb; since the 17th century vs a piece of 17th-century research (section A.1.1); -ize not -ise with a few exceptions (realise); also standardize on SR1.5 or SR15 -- note SR15 is necessary for social media as hashtags cannot include periods [Jonathan Lynn, Switzerland]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50061	1		57		The SPM is very long and covers a wide range of topics - it would be useful to have a short contents/summary outline at the start to make it easier to locate relevant information. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We significantly reduced the length of the revised version of the SPM and included a table of content.
50063	1		57		The SPM is often reviewed in order to ascertain the key headline messages - ensuring the inclusion of infographics that clearly highlighting the statistics/findings for each chapter in an understandable form would aid the digestion of this document and it's key messages. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
50065	1		57		It may help to prominently signpost at the start of the SPM to the Glossary to aid understanding of specific terms. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
86175	1		57		Need to make connection to past reports through some kind of translation exercise as relates to temperature changes. It seems a way to communicate the numbers could be 1) to show future projections in GMST/GSAT always relative to current warming. 2) report historical warming using the definitions of AR5 and AR6, and 3) When showing future projections including the historical change. [Debra Roberts and the Durban WGII TSU, South Africa]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
86177	1		57		To enable effective messaging around temperature in the SPM a clear distinction must be made between three factors: a) change of metrics (GMST vs. GSAT), b) change of estimates using the same metric (through the reworking of data sets), and c) updates due to addition of new very warm years. This needs to be done in a way that does not make the policy makers doubt the science/scientists (i.e. why so many technical changes so late in the IPCC game?). Also need to make a clear connection to past reports (AR5 and the 3SRs) and to do a translation exercise for the policy makers in terms of bring forward the figures from those reports and translating them into the new metrics. It is important to build on the story already developed for policy makers in this assessment cycle. Finally, the mix of GMST and GSAT in the SPM is very confusing - is it not possible to stick to using GMST and GSAT together consistently throughout? [Debra Roberts and the Durban WGII TSU, South Africa]	<p>1+2) Taken into account. In the FINAL (approved) SPM, A1.2 and footnote 10 detail the warming since AR5 and the reason behind this warming</p> <p>3) Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
110759	1		57		Great work, congratulations ! Not much left to say... [cathy clerbaux, France]	Noted with thanks.
87799	1		57		The summary is too long as it is now. It needs to be shortened and written in a form that better takes into consideration the target groups of politicians, decision makers and policy makers. [Ida Kristin Danielsen, Norway]	Accepted. We significantly reduced the length of the revised version of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86527	1		57		The draft SPM reads well, the main policy relevant findings of the report are presented concisely and using the calibrated uncertainty language. It is recommended that the most relevant findings and diagrams are also included in the TS which can provide a safe haven in case of a mutilating impact of the final approval session on the SPM. [Jochen Harnisch, Germany]	Noted. The revised SPM builds on the summary statements from the TS, to better support the findings presented in the SPM and improve the traceability of the report.
131631	2	0			footnote: near-term will overlap with now once the reports are approved in 2021/2022 [Hans Poertner and WGII TSU, Germany]	Noted but this is a result of using climatological reference periods that span across decades.
129695	2	1	2	1	In footnote 4, CMIP6 is not defined. [Trigg Talley, United States of America]	Not applicable. CMIP6 no longer mentioned in the equivalent footnote (footnote 15)
26341	2	1	2	1	Suggestion: include index [María Santolaria-Otín, France]	Accepted. An Index will be included in the report when published.
87147	2	1	2	21	Please consider to include an introductory para where you describe that graphics in the summary are deliberately ment to be as simple as possible since they are meant to communicate directly to non- experts and to policymakers. In such a para you should also explain that more comprehensive versions of the SPM figures are provided in the technical summary. The intention/purpose text for each figure together with an introductory para up front should in our view give you enought leeway to really provide simplified graphics that helps the readers to understand the messages that stems from your synthesis and assessment of relevant scientific litterature. [Oyvind Christophersen, Norway]	Rejected due to space limitations. We aim for a short and focused SPM.
87149	2	1	2	21	Please consider to include some wording from, and at least an explicit reference, to Cross-Chapter Box 1.1 "The WGI AR6 Contribution and its Relevance for the global stocktake". [Oyvind Christophersen, Norway]	Taken into account. Cross-chapter box 1.1 is referred to in HS10.
5243	2	1	4	14	The first few pages of the SPM absolutely need to be restructured. There are pages of jargon before the meat of the SPM starts. I have seen similar problems before in drafts of the SPM in earlier WG1 reports. For my credibility here, I can say I am responsible as a reviewer for much of the first page of the AR4 SPM. Remember the audience of the SPM. It is not a summary for other climate scientists – that is the technical summary. Its audience is supposed to be policy makers, including their staffs and people like science writers. These are busy people. They are not going to wade through pages of IPCC jargon to get to the main conclusions. [Daniel Murphy, United States of America]	Taken into account. The introduction has been kept and has a style and content that are very similar to those of past WGI SPMs. However, box spm.1 has been removed and the structure of the SPM has been completely revised, to provide important and policy-relevant content earlier in the document.
5245	2	1	4	14	Look at the SPMs for both AR4 and AR5. Each has an introduction of no more than a half page. That means the conclusions themselves start on the first page of text. I cannot emphasize highly enough that the meat of the summary has to start ON THE FIRST PAGE OF TEXT. Both AR4 and AR5 managed this. [Daniel Murphy, United States of America]	Accepted. The revised introduction is now only half a page long. Note however that the layout of the document sent out for review is very different from the final layout.
44953	2	1	57	1	This is called a "Summary for Policymakers," but it reads like it is a summary for scientists. I highly recommend that you get experts in science communication-- world leaders in Science Education--to help you rethink this entire section for next year. Otherwise, I fear the people who need to read this the most, will never make it beyond the introduction. [Catherine Linsky, United States of America]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible (in collaboration with communication experts). Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
37193	2	3	2	6	While this might be the intent of WGI, very little assessment per se is undertaken. [John McLean, Australia]	noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37195	2	3	2	6	Like other chapters of this report, you use the word "evidence" but fail to specify what the evidence relates to. [John McLean, Australia]	Rejected. "evidence" is defined in the glossary.
44949	2	3	2	8	Science communication concern: I think it is important for policymakers to see the total number of reviewers from however many countries that collaborated in the creation of the document. [Catherine Linsky, United States of America]	Rejected but this information will be available on the IPCC website and in other communication documents. We do not think it is necessary to mention this number explicitly in the SPM itself.
26247	2	4	2	5	Here could be useful to add the cut-off deadlines for the literature assessed in this report (for SR1.5, this information was included as footnote). [Tania Guillén Bolaños, Germany]	Accepted. Footnote 3 now mentions the cut-off deadline for the literature acceptance.
77673	2	4	2	6	suggested change: "...updated state of knowledge related to the climate system (the atmosphere, ocean, land surface, cryosphere and biosphere) and climate change, based on the assessment of evidence available in the scientific literature." in order to avoid saying "related to the climate system" twice [Emer Griffin, Ireland]	Taken into account. Introduction has been streamlined and repetition removed.
29193	2	5	2	6	(the atmosphere, ocean, land surface, cryosphere and biosphere) -> (the atmosphere, ocean, land surface, cryosphere, and biosphere) The final comma "," might be required according to Strunk & White "The Elements of Style" where they recommend the expression "red, white, and blue". This comment applies to similar sentences throughout the text. [Hiroshi Kanzawa, Japan]	Editorial. This kind of issues will be fixed during the production phase of the report.
97151	2	5	2	6	The introduction to the SPM states, that the Biosphere is part of the "evidence available in the scientific literature related to the climate system", implying it is a main part of the SPM and the report of WG 1. At the same time, biosphere (vegetation) and soils (especially peat) are only partially covered as sinks and sources in the climate system in this report and not mentioned at all in the SPM. If they are covered in the report, they are less visible and covered in less detail in comparison to other parts of the climate system. As some basics regarding biosphere, soils and land use are covered in the reports of WG 2 and 3, this should be explicitly mentioned here in the introduction. Otherwise, biosphere, soils and land use might be underestimated by the reader in their impact on the climate system, as the focus of this report (and SPM) is not stated clearly. [Nicole Wilke, Germany]	Not applicable - biosphere has been removed from the introduction.
38277	2	5	2	6	In "...climate system (atmosphere, ocean, land surface, cryosphere and biosphere)", land surface is not in parallel with cryosphere and biosphere, and it is also inconsistent with the definition of "climate system" in the AR6 glossary, according to which it is suggested to modify the related expression. [Yaming LIU, China]	Taken into account. This sentence has been removed from the introduction.
90715	2	6	2	6	Write: "... builds upon also on previous work of the IPCC in particular the WGI contribution ..." [José Romero, Switzerland]	Taken into account. Sentence has been revised to "The report builds upon the IPCC's Fifth Assessment Report (AR5), and the three AR6 special reports."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
96897	2	6	2	7	AR5 and the 6th assessment series (SR1.5, SROCC, SRCCL) are called out, but what about AR4, TAR, SAR and FAR? For context, at least in my frame of view, this has been a building knowledge base that started prior to the publication of the FAR in 1990, with successive and strengthening statements building through the series. For context, in Ch3 we open with a reference of the SAR (1995) and "...discernable human influence on climate" as we believe this is the origin point to start off with in the chapter. I note this is mentioned in A.1.6, but bringing it forward would be useful [Paul Durack, United States of America]	Noted. We do not think it is necessary to call out reports that were released before AR5 given that each IPCC report explicitly builds on report from the previous assessment cycle. As a result, AR5 builds upon AR4, which builds upon TAR etc. Furthermore, not doing so enables us to save space and keep the SPM shorter.
53443	2	6	2	7	as well as on the 6th phase of the Coupled Model Intercomparison Project (CMIP6) although many quoted studies are still based on CMIP5 results. [Hervé Douville, France]	Rejected. This statement is more general, therefore we do not see the need to cite CMIP6 or CMIP5 explicitly here.
86455	2	6	2	8	It is not clear what is meant by 'builds on' here. Please expand. Our understanding is that the main purpose of AR6 is to present and assess new evidence, since AR5 and also compared to the special reports in the AR6 cycle [Ala Taimar, Estonia]	Rejected. The term 'builds' has been retained. The reviewer's understanding is correct.
27669	2	7	2	7	Specify which reports in words for more clarity ("on a global warming of 1.5°C (SR1.5), on the ocean and cryosphere in a changing climate (SROCC), and on climate change and land (SRCCL)"). [Eric Brun, France]	Accepted. Full names of the reports are provided in footnote 2 in the revised SPM.
17419	2	7	2	8	It would be helpful to put dates against the publication of AR5 and the SRs. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Rejected due to space limitations.
17711	2	7	2	8	Consider writing out the full name of the Special Reports. [Anette Jönsson, Sweden]	Accepted. Full names of the reports are provided in footnote 2 in the revised SPM.
131633	2	7	2	8	I suggest proving full titles of the three Special Reports instead of the acronyms [Hans Poertner and WGII TSU, Germany]	Accepted. Full names of the reports are provided in footnote 2 in the revised SPM.
64821	2	7	2	8	I think it would help the understanding of the reference to the special reports (SR1.5, SROCC, SRCCL), if their abbreviations were spelled out once. [Lea Beusch, Switzerland]	Accepted. Full names of the reports are provided in footnote 2 in the revised SPM.
110761	2	7	2	8	spell SR1.5,SROCC, SRCCL (as SPM should be read as a stand alone doc) [cathy clerbaux, France]	Accepted. Full names of the reports are provided in footnote 2 in the revised SPM.
17423	2	8			The text explains how this report fits with AR5 and the SRs but does not explain how the contributions from WGII and III will take forward this work. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. It is beyond the scope of the WGI to cover the mandate of the other WGs.
131635	2	10	2	10	I think it should say "A: Understanding THE EMERGENCE OF human-induced..." [Hans Poertner and WGII TSU, Germany]	Not applicable. Section A removed from revised SPM.
37197	2	10	2	11	This breakdown is foolish given that part A consists of two very disconnected matters. The SPM should have five parts, not four. [John McLean, Australia]	Taken into account. Section A removed from revised SPM.
97153	2	10	2	11	Title of part A should read "Understanding the emergence of human-induced climate change and communicating information" for consistency with actual title on page 4, lines 1-2. [Nicole Wilke, Germany]	Not applicable. Section A removed from revised SPM.
129697	2	10	2	12	This line says that the SPM is structured in 4 parts, with Part B consisting of the current state of the climate: where we are now and how did we get here. Chapter 1 tries to cover all of Part B, yet does not do a very good job at introducing and sharing this Part B concept. None of the Chapter 1 figures are used in the SPM and very little of the text and key messages are either. Perhaps consider adding something like Figure 1.9 (signal and signal-to-noise ratio). [Trigg Talley, United States of America]	Taken into account. The goal of the SPM is to integrate and synthesise the most policy-relevant findings across the report chapters. Almost all SPM Figures are now developed to include assessment results across multiple chapters, including core concepts and results covered in Chapter 1. Figure 1.9 was not included in the SPM as it was considered too narrowly focused.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44681	2	11	2	11	It is rather unexpected that the report goes into discussing "communicating climate information" as a topic in itself, in WGI. (Provision of regional information, such as regional scenarios is relevant, which also is in line with the SPM-outline.) If a short bullet on this nevertheless were to be retained, most of the substance would seem to be in A3.3 and to a considerably lesser degree in A3.4. The matter is important, but perhaps not a core issue for WG1-SPM. Suggest deletion, incl A3.3 (also for brevity), and a short title for Section A. [Markku Rummukainen , Sweden]	Taken into account. Section A has been removed from the revised SPM. The important information it contained has been integrated in the new sections.
20917	2	11	2	11	We need to replace communicating climate information with " communicating Climate Change Information" [Ladislav Chang'a, United Republic of Tanzania]	Not applicable. Section A was removed from the revised SPM. Note however that climate information includes information on climate change.
65015	2	11	2	12	"Where are we now and how did we get here" to me is too anthropocentric. It is not like we fully control climate. What about: "The current state of climate and its past changes". Same for "our possible futures", simply "possible futures" are much better. [Johannes Quaas, Germany]	Taken into account. The 1st section is now called 'current state of the climate'
77675	2	11	4	2	Name of section A mismatch [Emer Griffin, Ireland]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
17421	2	11			Communicating climate information: this doesn't sit well in this section (perhaps even in this SPM) and the content doesn't seem particularly informative as it stands. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section A removed from revised SPM.
110971	2	11			Communicating climate information: this doesn't sit well in this section (perhaps even in this summary) and the subsequent content isn't particularly informative. [Monica Dean, United States of America]	Taken into account. Section A has been removed from the revised SPM. The important information it contained has been integrated in the new sections.
8065	2	12	2	12	Mention who is the targetted audience for this Atlas. [Frank Dentener, Italy]	Rejected. This document is the summary for policymakers and the targeted audiences for other parts of the report are not mentioned in this document. Note however that the introduction now mentions that 'The novel AR6 WGI Interactive Atlas provides access to climate change information, including across the WGI reference regions'
19531	2	14	2	15	In addition to these introductory paragraphs and the confidence/likelihood assessments, italics are used several times throughout the SPM. This occurs often for paragraphs just before the legends of figures. Another, more puzzling example, is paragraph C.1.3. Please explain. [philippe waldteufel, France]	Noted. Italics were used for the preambles of each section, the uncertainty language, and to present the intent of each figure.
65057	2	17	2	17	The likelihood and likelihood ranges (e.g. the terms terms likely and likely range) can be confusing, since also the likelihood levels have ranges associated with them. Could examples be provided? [Magnus Joelsson, Sweden]	Taken into account. Footnote on confidence language (footnote 5) is rephrased and ranges are no longer mentioned.
78649	2	17	2	17	The links given below (like "{1.3.3, 1.3.4}") relate to the main document, I assume!? Shouldn't that be clearly said somewhere, best in this paragraph? (I first thought it referred to other parts of this SPM and was confused.) [Heike Wex, Germany]	Taken into account. The revised introduction mentions that 'The underlying scientific basis for each key finding is given by references to the main Report, indicated in curly brackets, and to the integrated synthesis of the Technical Summary in square brackets'.
80061	2	17	2	17	Footnote 1, 7-8th line: Not clear why this range is needed, why does 17-50% probability mean 'likely'? Moreover, could be confusing for policymakers given the previously already defined likelihoods. [Lilian Fejes, Hungary]	Taken into account. Footnote on confidence language (footnote 5) is rephrased and ranges are no longer mentioned.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108529	2	17	2	17	In footnote 1 final line I think you need 'respectively' at the end of the sentence. [Jason Donev, Canada]	Taken into account. Footnote on confidence language (footnote 5) is rephrased and ranges are no longer mentioned.
103971	2	17	2	19	Footnotes 1 and 2: Maybe these notes require further clarification, to better explain the factors leading to the assessment of the confidence (e.g., whether they reflect the number of peer-reviewed papers or the fundamentals of our understanding). This would allow to clarify for policy-makers that "low confidence" assigned to a phenomenon (e.g. carbon release from permafrost melting) does not necessarily mean that the phenomenon is uncertain to emerge, but that there is not enough literature to constrain its impact. [Philippe Tulkens, Belgium]	Rejected due to space limitations. These concepts are explained in the IPCC Guidance Note on the Consistent Treatment of Uncertainties.
37199	2	17	2	19	You describe three approaches to deciding uncertainty. State clearly whether the method of derivation will be made clear whenever uncertainty is mentioned. [John McLean, Australia]	Taken into account. The introduction and footnotes have been rephrased for clarity. Additionally, a traceable account of these concepts are explained in the IPCC Guidance Note on the Consistent Treatment of Uncertainties.
50069	2	17	2	19	"Probabilistic estimates of quantified measures of uncertainty in a finding are based on statistical analysis of observations or model results, or both, and expert judgment" - this is written in a very scientific way which may not be understood by a non-scientist, would it be possible to briefly explain the term 'probabilistic estimates'? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed from revised SPM.
108075	2	17	2	20	"Confidence in key findings is indicated using the IPCC calibrated language. Probabilistic estimates of quantified measures of uncertainty in a finding are based on statistical analysis of observations or model results, or both, and expert judgment." [Anton Holland, Canada]	Noted. (this is repeating the sentence written)
5247	2	17	2	21	This is too technical for the introduction. Picture a member of parliament somewhere (or more likely their staff member) starting to read the SPM. They hit this paragraph on the first page. Is this going to draw them into reading the main conclusions or is it going to discourage them from reading further? The AR5 version of this same paragraph is less technical. [Daniel Murphy, United States of America]	Taken into account. This part of the introduction has been simplified and shortened in the revised SPM.
97155	2	17	2	21	Essential information on the IPCC'S "calibrated uncertainty language" is hidden in 3 footnotes. We understand that the inclusion of a box in the main text would not be useful due to the limited space in the SPM. We kindly request the inclusion of a reference to TS Box 1.1: "Treatment of uncertainty and calibrated uncertainty language used in IPCC reports". [Nicole Wilke, Germany]	Not applicable. There was no box TS1.1 and no box on uncertainties in the TS however the introduction and footnotes have been rephrased for clarity and streamlined. Uncertainty is now covered in 2 footnotes, not 3 (footnotes 5 and 7).
44951	2	17	2	21	Science communication concern: I recommend that you have an expert in science communication help you with the drafting of this entire document. This particular section, for example, will be very confusing to many policy makers. Providing examples of what each of the confidence indicators mean will help. I don't think it is safe to assume they will look at the footnotes. [Catherine Linsky, United States of America]	Taken into account. The SPM has been completely rewritten and restructured and this was done in collaboration with communications experts. The part of the SPM mentioned in the comment has also been simplified.
97157	2	19	2	19	Footnote 2: for the unexperienced reader, it is not clear what this refers to. Please change to "...unless stated otherwise, uncertainty of specific values given in the text is quantified..." [Nicole Wilke, Germany]	Taken into account. This information now appears in footnote 8 of the revised SPM, whose wording is very different from that of former footnote 2.
129699	2	19	2	19	Can "expert judgement" be quantified? This phrasing might raise red flags. Recommend rephrasing. [Trigg Talley, United States of America]	Accepted. 'Expert judgement' no longer features in revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
109707	2	21	2	21	Footnote 3: I think there's a typo here, should perhaps be "predate the industrial period"...? [Sean Fleming, United States of America]	Editorial. The typo has been fixed in footnote 15 of the revised version (which has been significantly rewritten).
107937	2	21	2	21	footnote 3 says that 1850-1900 is a pragmatic approximation to pre-industrial T. It would be strengthened by adding: "the suitability of this approximation is assessed in {section X.X.X}" and make sure an assessment is included in chapter X.X.X. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The footnote on reference periods has been moved to HS.5 and simplified to read "The multi-century period prior to the onset of large-scale industrial activity around 1750. The reference period 1850–1900 is used to approximate pre-industrial global surface temperature."
80063	2	21	2	21	Footnote 3, 4-6th line: The current text suggests that historical and modern periods are equivalent. We suggest using a starting year for historical CMIP6 or at least writing that in AR5 the modern period was 1986-2005. [Lilian Fejes, Hungary]	Taken into account. The revised SPM no longer mentions the modern or historical periods and is explicit with the time periods assessed. Furthermore, for clarity, the revised SPM only focuses on the 1850-1900 baseline (except for sea level rise in figure SPM.8 and HS9.3)
97159	2	21			The use of "baseline" should be avoided as there is confusion if it refers to preindustrial conditions, or to a business-as-usual emission scenario, or to a mitigation scenario entirely without mitigation. [Nicole Wilke, Germany]	Accepted. 'baseline' no longer features in revised SPM.
97161	2	21			Please see our general comment on the "reference period". [Nicole Wilke, Germany]	Noted.
5251	2	24	2	34	The footnotes are also very technical. Note that AR5 referenced the technical summary for this: AR5 said "(See Chapter 1 and Box TS.1 for more details about the specific language the IPCC uses to communicate uncertainty)." [Daniel Murphy, United States of America]	not applicable - box SPM.1 no longer exists in the revised SPM.
129701	2	24	2	34	[GSAT] Consider changing the words "An adjustment is applied..." to something like "GSAT and GMST are mathematically related." And then fully explain in a footnote. The word "adjustment" related to data has been a lightning rod in past reports. [Trigg Talley, United States of America]	not applicable - box SPM.1 no longer exists in the revised SPM.
89639	2	24	3	38	In addition to the concepts currently introduced in Box SPM.1, the concept of radiative forcing should be included. We can't assume that policy makers will be familiar with this term, which is used without any introduction in the box [Trude Storelvmo, Norway]	Not applicable, box SPM.1 on the core concept central to the report has been removed from the SPM but a revised and more complete version has been added to the TS.
77111	2	24	3	39	A simplified version of figure 7.2 with correct text in box (see comments on 7-175) which includes ERF (warming cooling) and without AR5 material can be used to illustrate what is described as the fundamental driver of climate change (7-23; 39-41) [Emer Griffin, Ireland]	not applicable - box SPM.1 no longer exists in the revised SPM.
77113	2	24	3	39	A simplified version of figure 7.2 with correct text in box (see comments on 7-175) which includes ERF (warming cooling) and without AR5 material can be used to illustrate what is described as the fundamental driver of climate change (7-23; 39-41) [Emer Griffin, Ireland]	not applicable - box SPM.1 no longer exists in the revised SPM.
5249	2	24	3	40	I had real problems with this box. Even being a previous IPCC author, I found this really dense and hard reading. I doubt the SPM audience will understand it. Move it to the technical summary. [Daniel Murphy, United States of America]	Accepted, box SPM.1 on the core concept central to the report has been removed from the SPM but a revised and more complete version has been added to the TS.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97163	2	24	3	40	An explanation of the central concepts is appreciated but we strongly prefer referring to the glossary. This will avoid the subjective and difficult choice of issues to be included in this box. We suggest providing footnotes citing verbatim text from the glossary. All the entries of the current Box SPM.1 should also be part of the glossary, with some revisions as outlined in our comments on the specific entries. [Nicole Wilke, Germany]	Taken into account, box SPM.1 on the core concept central to the report has been removed from the SPM but a revised and more complete version has been added to the TS.
27671	2	26	2	26	We suggest adding a definition of the "earth's energy budget" mentioned in section A and al. [Eric Brun, France]	not applicable - box SPM.1 no longer exists in the revised SPM.
108173	2	26	2	34	The text contained in this box is an improvement on the way content is presented in this summary overall [Anton Holland, Canada]	noted with thanks.
131637	2	26	3	32	Looked up all terms in the Box SPM.1 in the Glossary. The following terms are missing in it: "Global surface temperature", "Global warming levels", Climatic impact drivers", "Risk framework", "Storylines" (The term is in Glossary, but description is different), "Low-likelihood, high impact events", Internal variability (the term is there, but no description), natural variability (missing) [Hans Poertner and WGII TSU, Germany]	Not applicable, box SPM.1 on the core concept central to the report has been removed from the SPM but a revised and more complete version has been added to the TS.
12623	2	26	3	37	The box, for now, is a gather of some definitions, it is not optimal from the readability point of view. The box can be improved if it is organized as several paragraphs using "storyline" approach. It does not need to be holistic here, some definition and concept can be explained later via footprint. As an opening box, readability is more important. [Lijing Cheng, China]	Taken into account, box SPM.1 on the core concept central to the report has been removed from the SPM but a revised and more complete version has been added to the TS.
37779	2	26	3	37	There is a conceptual explanation for 'Global warming levels', but there is no conceptual explanation for SSP, which has similar importance, so it needs to be added. [Junhee Lee, Republic of Korea]	not applicable - box SPM.1 no longer exists in the revised SPM. Note however that the SSPs were explained in box SPM.2 on scenarios and modelling.
90717	2	28	2	28	Write: "... which are relevant to the AR6, with a focus ..." [José Romero, Switzerland]	not applicable - box SPM.1 no longer exists in the revised SPM.
20327	2	28	2	29	It would be useful to develop in this box what is meant by "assess" and "assessment", words used more than 2600 times throughout the SOD. This remark will be developed in comments concerning the entire report. [philippe waldteufel, France]	not applicable - box SPM.1 no longer exists in the revised SPM.
101497	2	28			Change "key concepts and definitions which are relevant" to "key concepts and definitions that are relevant" [Knute Nadelhoffer, United States of America]	not applicable - box SPM.1 no longer exists in the revised SPM.
27673	2	31	2	31	The change from "GMST" to "GSAT" is insufficiently argued and introduces ambiguities in understanding. The reader may wonder what is actually the difference between these two indicators, and how true/false are the values given in previous ARs if they used the wrong surface temperature indicator. It could be misleading and more, it could be used by detractors. Moreover, the continuity of climate series has to be ensured, if we changed the indicator. Yet, we emphasize the importance of this choice, and its consequences on how to express some essential aspects of climate change, as properly and clearly developed in Cross Chapter Box 2.3. Such a choice can be made only if WG2 and WG3 adopt a similar and consistent approach. In the rest of the report 'GMST' is sometimes used and sometimes it is the 'mean GSAT'. This leads to confusion. It even seems that GMST is much more frequently used than GSAT in the Chapters. [Eric Brun, France]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

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8063	2	31	2	31	It is not sufficient to refer to cross-chapter box 2.3. A footnote could help to briefly explain what is the difference between GMST (a somewhat ambiguous mix of SST and land air temperature) and GSAT, why this change is needed, and that there are consequence wrt to the Paris Agreement targets in terms of differences between GMST and GSAT. It should probably also mention why despite this change- still a number of analysis in this report (and SPM) are performed in terms of GMST. [Frank Dentener, Italy]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
97165	2	31	2	31	Definition of GSAT: in the glossary it is referred to "Global surface air temperature" whereas in SPM it is referred to as "Global mean surface air temperature". Please, adjust. [Nicole Wilke, Germany]	Not applicable. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
3579	2	31	2	31	AR6 has changed the metrics of temperature from GMST to GSAT without showing persuasive reasons. This has a huge effect to carbon budget, one of the most important information on climate mitigation. Clear reason should be shown here. Just for authors information Chapter 1 of SR1.5 describes as follows; "The IPCC has traditionally defined changes in observed GMST as a weighted average of near-surface air temperature (SAT) changes over land and sea surface temperature (SST) changes over the oceans (Morice et al., 2012; Hartmann et al., 2013), while modelling studies have typically used a simple global average SAT) p.56 1.2.1.1. Also in 1.5SR SPM GMST is explained as one of Core Concepts central to the report (p.26). [Mitsutsune Yamaguchi, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
80059	2	31	2	33	No clear definition is provided of these two indicators. No information why this new measure (GSAT) is needed and used. Please provide them. [Lilian Fejes, Hungary]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
41995	2	31	2	34	The distinction between GAST and GMST requires a brief explanation. Please indicate the basic difference (GAST uses near-surface air temperature everywhere but GMST sea surface temperature over the ocean) and why the increase in GAST is larger (larger warming of air temperature than surface temperature over ocean). [Juhani Damski, Finland]	<p>Not applicable.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
131643	2	31	2	34	the use of GSAT has implications for WGII and WGIII - will the consistency among reports including the Special Reports be difficult to follow if there is a switch to this metric? [Hans Poertner and WGII TSU, Germany]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131645	2	31	2	34	include the description of GSAT and GMST (from glossary) so the reader can understand the difference [Hans Poertner and WGII TSU, Germany]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
12625	2	31	2	34	Using GMAT instead of GMST is a very good choice and a big step forward, but it need some explanation of why GMAT is preferred, why it is more scientifically correct to use GMAT? [Lijing Cheng, China]	<p>Not applicable.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
2921	2	31	2	34	Did GSAT include both land and sea? It should mention clearly. It should provide the main difference between GSAT and GMST, as well as why using GSAT. The GMST was used from FAR to AR5. The GMST is not equal to GSTA (see cross chapter-box2.3-Fig1). [Zong Ci Zhao, China]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42381	2	31	2	34	Difference between GSAT and GMST should be clarified and reason for choice should be made clear. [Tina Christensen, Denmark]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
34959	2	31	2	34	Detailed Comments by SOD Chapter – SPM: The SOD proposes the adoption of the artificially-derived metric of Global Surface Air Temperature (GSAT). Please refer rebuttal comment #1 above. [Jim O'Brien, Ireland]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
110763	2	31	2	34	The choice GSAT vs GMST is a bit mysterious. Explain why in a footnote? [cathy clerbaux, France]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20919	2	31	2	34	The Use of GSAT instead of GMST and thus departing from what was used in AR5 and the recent three Special report does not serve the purpose of communicating to Policy Makers by introducing new terminologies. If GSAT is the adjusted GMST, why not say GMST was slightly adjusted. We suggest a careful consideration be given and if there is no substantial difference better used much understood and widely used terminologies. We lose consistency and comparability. [Ladislaus Chang, United Republic of Tanzania]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
117185	2	31	2	34	the brief definition of GSAT should be included here. For the discussion about difference with GMST reference to the Box is fine [Maisa Rojas, Chile]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
29379	2	31	2	34	The explanation of / the relation between GMST and GSAT is unclear, with respect to the question of GMST being really the surface or the surface air temperature? [Joachim Fallmann, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112601	2	31	2	34	The SPM of the IPCC SR1.5 introduced a number of core concepts, including GMST, pre-industrial, global warming, total and remaining carbon budget, discussed and agreed in plenary as consistent with the understanding of these concepts at the time of the Paris Agreement. A very strong reason would therefore be required to redefine these concepts. Redefining global warming in terms of GSAT, particularly when it is acknowledged (Chapter 2, page 40, lines 6-17) that the targets in the PA were "predicated on the assumption of 0.85°C by 2012" (a number that was unambiguously defined in terms of GMST), is deeply policy prescriptive and I don't understand the justification for it. Introducing the option of defining global warming relative to 1750 also seems potentially confusing: certainly some qualifier that it is defined relative to 1850-1900 unless otherwise specified seems sensible. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
107787	2	31	3	1	This information appears to be important "Global surface temperature indicators: Global surface air temperature (GSAT) is used as the principal surface temperature metric throughout this report. This is a distinct choice compared to AR5 and the three AR6 cycle special reports. An adjustment is applied to observed global mean surface temperature (GMST) products to account for non-equivalence between GSAT and GMST that is growing as the climate system continues to warm 4. {Cross Chapter Box 2.3}" but the information on the footnote 4 does not answer the why. Why have you changed from GMST to GSAT ? is it some kind of change that could be challenged ? [FREDERIC MENARD, France]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.""
103973	2	31	3	1	It is not sufficient to refer to cross-chapter box 2.3. A footnote could help to briefly explain what is the difference between GMST (a somewhat ambiguous mix of SST and land air temperature) and GSAT, why this change is needed, and that there are consequence wrt to the Paris Agreement targets in terms of differences between GMST and GSAT. It should probably also mention why despite this change- still a number of analysis in this report (and SPM) are performed in terms of GMST. [Philippe Tulkens, Belgium]	Not applicable. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
88873	2	31	3	1	After attending BOG1 at the pre-LAM activities this week I am unconvinced this assessment of the GSAT to GMST conversion is reasonable. It is based on climate models and reanalysis, which in this regard (surface vs. 2-meter temperature) is completely parameterised and unconstrained by observations. Available ocean-based night-time air temperatures, as presented by Ed Hawkins, warm slower than the ocean surface temperature. This means models and observations show the opposite sign of the correction, and I think it is inappropriate to assess this to be positive with high confidence. [Thorsten Mauritsen, Sweden]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
17713	2	31	3	1	Consider adding a comment on why GSAT is chosen instead of GMST. [Anette Jönsson, Sweden]	<p>Not applicable.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
131639	2	31	3	1	As a non-expert it is difficult to understand why GSAT seems to be the better temperature metrics, so I was wondering if it would help to explain how both parameters are measured in a footnote; the footnote given (4) does not help to understand, why you choose GSAT over GMST [Hans Poertner and WGII TSU, Germany]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

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41281	2	31	3	1	Please add the main reason why this choice has been made, i.e. to not underestimate historical warming and better link obs to projections. Only referencing the cross-chapter box is not enough. Due to the fundamental implications of this metrics change (an additional 0.1 degC compared to the AR5 assessment that causes lower probabilities of meeting the 1.5 degC goal with SSP1-19, and remaining carbon budgets to shrink) more explaining is needed up-front. Currently, the whole discussion on implications is hidden away in the chapters, particular chapter 2, or is non-existent. If WGI does not provide a clear narrative and line of sight to AR5, there is a huge risk of introducing confusion and inconsistencies across WGs, particular WGIII. Please pay particular attention to this matter and revise the way this change is introduced. Otherwise, this may become a serious issue with dangerous messages that could be misused under the UNFCCC (1.5 not longer feasible etc.). [Alexander Nauels, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
37201	2	31	3	1	Wrong. There have never been a global surface air temperature (GSAT) or a global mean surface temperature (GMST) because the data coverage of the earth's surface is inadequate to know the average global temperature at any point in time. You need to talk about temperature anomalies rather than temperatures per se. If global coverage was always close to 100% then the variation in GMST would (or at least should) be the same as global mean surface temperature anomaly, but coverage is now in the 80% to 90% range having been as low as about 15% in the past, so neither GSAT nor GMST can sensibly be used. [John McLean, Australia]	Rejected. The limited sampling in earlier parts of the record is known, and incorporated in the uncertainties of the assessed global surface temperature. Furthermore, Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. Refer to the Cross-Section Box TS.1 for further details.
78945	2	31	3	1	The preference for GSAT should be justified, and other differences regarding its calculation for period starting in 1850 should be provided so as to explain why the GSAT warming for 2009-2018 is 1.1°C above 1850-1900 while the SR15 indicates that the GMST warming for a period centered around 2017 was 1.0°C above 1850-1900 (this is more than the 4% changes attributed to GMST/GSAT, so if other changes such as regarding incomplete coverage of observations play a role, this needs to be indicated in the SPM). [Martine Vanderstraeten, Belgium]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
112247	2	31	3	1	As it stands, there is no clue provided in the SPM itself in what way the definitions of GMST and GSAT differ, namely that either the surface temperature or the 2m-temperature is used over the ocean (making GSAT consistent between ocean and land). One would need to read Box 2.3 in chapter 2 to find this key information. I think this should be mentioned in the SPM (maybe by adding just one sentence in footnote 4). [Helge F. Goessling, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
38279	2	31	3	1	In the report, the GSAT (Global Surface Air Temperature) is mainly used as an indicator for the global warming. In some places in the text, however, it is GMST (Global Mean Surface Temperature) that is used. For example, in lines 22-32 on page 11, Figure SPM.4. At the same time, GMST is also used several times in SPM (line 4 on page 23, line 8 on page 48), which may cause confusion. It is suggested to clearly distinguish GSAT from GMST in SPM by referring to Box 2.3 in Chapter 2, so that policy-makers can better understand them. [Yaming LIU, China]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
131977	2	31	3	1	Highly important: It does not suffice to introduce a new measure for global mean temperature, GSAT, like this. Also, any revision of historical warming needs to be mentioned in the SPM. First a reason should be given for such deviation from previous assessments. Second, this may have major implications for assessing impacts and relating impacts to global mean temperature as reported in the literature. Third, this changes the reference temperature for the Paris agreement which builds on impact observations and those relate mostly to GMST including AR6 SRs. Therefore, GMST values should continue to be provided. Best would be a table where GMST and GSAT value are compared for different degrees of global warming and where any shift in the estimate of historical warming is clearly flagged. The importance of distinguishing between GMST and GSAT became apparent in SR1.5. The meaning for the temperatures of the Paris agreement needs to be carefully assessed and quantified. [Hans Poertner and WGII TSU, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
69281	2	31	3	1	It would be useful for readers if the definitions of the GSAT and the GMST, as explained in Cross-Chapter Box 2.3, were included in the SPM. In addition, detailed description of method to adjust the GMST to the GSAT would also be useful. [Kaoru Magosaki, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

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129703	2	31	3	1	[GSAT] Better explain the choice and usage of GSAT over GMST. [Trigg Talley, United States of America]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
129705	2	31	3	1	[GSAT] The implications and consequences of using GSAT vs. GMAT needs to be clarified. Is one more accurate? Why? Does one measure shift the temperature numbers/trends one way or the other? [Trigg Talley, United States of America]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
42157	2	31	3	1	Box SPM1: Clearer definition of GMST and GSAT is necessary as is a justification/motivation for the reason for the change in variable. [Tina Christensen, Denmark]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87235	2	31	3	1	Impacts of the change of GMST to GSAT seems to be not small. It is useful for introducing the difference of the basement of these analysis more for policy makers because it provide impacts on the definition of temperature of “temperature rise” at Paris Agreement and carbon budget or other politically important numbers. Policy makers have to pay attention on the consistency of policies. [Takashi Hongo, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
37621	2	31	3	1	It may be helpful to indicate here that GSAT warming is greater than GSAT. [Masahide Kimoto, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
104701	2	31	3	1	"Maybe should be briefly clarified what GSAT and GMST are and what is the difference between these two indicators. I think it is not so clear for a policymaker who could read this." [Andrea Bianchi, Italy]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

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131641	2	31	33	1	It does not really become clear why a different temperature metric than in the Special Reports is used [Hans Poertner and WGII TSU, Germany]	Taken into account Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM."
42637	2	31			Because this is a different approach to that used before, It would be useful to include a sentence saying why the decision has been made to focus on GSAT. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
103975	2	32	2	32	The wording "distinct choice compared to" is awkward. Consider "distinct difference compared to" or "distinct choice made since" or similar. [Philippe Tulkens, Belgium]	not applicable - box SPM.1 no longer exists in the revised SPM.
6345	2	33	2	33	Text needs rewording. GMST is not observed. It is a quantity estimated from observations. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Box removed from SPM.
103977	2	33	2	34	The sense of adjustment (positive or negative) to convert from GMST to GSAT should be provided. [Philippe Tulkens, Belgium]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25717	2	33	2	34	An explanation should be included for the adjustment mentioned to convert GMST to GSAT [Don Alfonso Pino Maeso, Spain]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
111619	2	33	3	1	Maybe give an indication of how large this correction is, so that the SPM is self-contained. This will be unfamiliar to many readers and they will want to know whether it can explain numerical differences from AR5. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
107939	2	33	3	1	text and footnote 4 use the word 'adjustment'. This can cause communication problems because it implies data are being 'adjusted', yet this is not really what is happening. Instead historicla changes in GSAT are being predicted using observation-based changes in GMST and a "model" (albeit simple) of the function that links the two. Perhaps better, therefore, to say something like: "Changes in GSAT are inferred from observed global mean surface temperature (GMST) datasets, taking into account the non-equivalence between GMST and GSAT that is growing as the climate system continues to warm" and footnote 4 "There is high confidence that GMST and GSAT differ and GSAT is estimated by increasing GMST changes by +4% [2-7%]." which avoids the use of the word "adjustment". [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The word 'adjustment' no longer appears in the context of global surface temperature.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
100345	2	33	3	1	It is difficult to understand the difference from GSAT and GMST [Claudine Dereczynski, Brazil]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
36013	2	34			footnote 2: if the 90% interval is the 5-95 = very likely above, then please note this. [Michael PRATHER, United States of America]	Taken into account. The revised footnote (number 8) now stated that the 90% range is the very likely range.
36015	2	34			footnote 3: This is very useful. Can you add what you would call the 2100-2300 simulations needed for sea level rise? [Michael PRATHER, United States of America]	Noted. Given that the period considered beyond 2100 depends on the context and the variable we are looking at, we do not see the need to define a name for that.
77589	2	35	2	35	CMIP6 aronym not explained [Emer Griffin, Ireland]	Accepted. CMIP6 explained in box spm1.
90885	2		2		Foot note 3. Three future reference periods are defined: 'near-term' (2021–2040), 'mid-term' (2041–2060) and 'long-term' (2081–2100) It would be useful needed to clarify the period 2061-2080. [Alvaro Zopatti, Argentina]	Rejected. This period was not an assessed reference period in the report and therefore does not need to be highlighted.
116067	2		2		The choice of GSAT needs to be clearly explained. [Valerie Masson-Delmotte, France]	Taken into account Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM."
116115	2		2		This box SPM1 lacks a precise definition of the duration over which climate change (global warming etc) is reported. In various parts of the report, periods of 20 years are used; in others, the last decade is used (latest warming level). This needs to be explained also in relationship to when levels of warming are reached (related to box SPM2). [Valerie Masson-Delmotte, France]	Not applicable, box SPM.1 has been removed from revised draft.
54437	2		2		Foot note 3. Three future reference periods are defined: 'near-term' (2021–2040), 'mid-term' (2041–2060) and 'long-term' (2081–2100) It is needed to clarify the period 2061-2080. [Maria del Pilar Bueno Rubial, Argentina]	Rejected. This period was not an assessed reference period in the report and therefore does not need to be highlighted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
14547	2		2		Footnote 1: I recall during LAM1 or LAM2 it was decided that AR6 would not use the likelihood categories of "more likely than not" and "about as likely as not"? Or maybe this was superseded at LAM3 which I could not attend [Roshanka Ranasinghe, Netherlands]	Rejected. This footnote lists all IPCC calibrated language terms of which "More likely than not" is one of them. This footnote does not indicate the amount each term is used during the SPM.
3573	2		2		Footnote 3. It would be better to show temperature change between 1750 and 1850-1900 here. Please refer to SPM p.10 line 4 where it is explained as -0,1 to 0.2°C [Mitsutsune Yamaguchi, Japan]	Not applicable. This number has been removed from the revised SPM, to shorten the document.
99943	2				The three footnotes at the bottom of page SPM-2 are so informational for not only the SPM, but for the entire report. Could they be redesigned or reconfigured somehow to make their information more accessible and readily available throughout the report? [Dan Helman, United States of America]	Rejected. The footnotes here are for the SPM only. The relevant information is also contained in the underlying chapters of the report where needed.
6347	2				Footnote 3 needs revising. Some temperature datasets used in this assessment, notably GISTEMP and NOAA GlobalTemp, begin only in 1880, as the spatial coverage is sparse for earlier years. So not all data producers consider data from 1850 onwards to be sufficient. Also, there is an argument, made in my general comments 2 and 3, that the 1850-1900 pre-industrial level should be fixed (pragmatically) at a level as estimated close to the time of the Paris Agreement, and thus not be a level that changes as estimates of the 1850-1900 average temperature change. Otherwise the targets of the Paris Agreement are moving ones. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Footnote 3 (now footnote 15) has been completely revised and shortened. A thorough assessment of the 1850-1900 reference period can be found in chapters 1 and 2.
117187	3	1	2	1	should (2%'7%) be in square braquests as foornote 2 indicates?? [Maisa Rojas, Chile]	Not applicable. Text removed.
15363	3	1	3	1	It is not clear the meaning of "adjustment" here in footnote 4. [Masaki Satoh, Japan]	Not applicable. Term no longer feature in the SPM in that context.
41221	3	1	3	1	Footnote 4: You mean adjustment to the deviation from the reference period? Otherwise it seems odd to quote an adjustment in % without specifying your temperature units. In fact, I am not sure GMST is ever presented as an absolute number in this report, rather than a deviation from a reference period, and maybe this should be made clear in the definition? [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54577	3	1	3	1	Footnote 4: The choice to use GSAT rather than GMST as the principal global surface temperature metric is an important one. Given this, it would be helpful if the distinction between these two terms were explained as part of the footnote as policy-makers are unlikely to know this. [Nancy Hamzawi, Canada]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
11571	3	1	3	1	In the footnote, it could be made clearer that this 4% adjustment applies to GSAT/GMST *changes* relative to the reference period. [Gerhard Krinner, France]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
19533	3	1	3	1	This comment actually refers to footnote (4), which is ambiguous. Looking carefully at CCBox 2.3 and the associated figure, it turns out that the percentage is meant to be applied to the increments of GSAT and GMST, rather than to GSAT and GMST [philippe waldteufel, France]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44683	3	1	3	1	In footnote 4, what does a percentage apply to, it would seem to be a strange measure for this (percent of difference in the two measures measured in Kelvin?). [Markku Rummukainen , Sweden]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
71319	3	1	3	1	Footnote 4: Citing an adjustment to temperature as a percentage is unsatisfactory - unless it refers to absolute temperature (°K). For example if the temperature under consideration were 0°C, then an adjustment of 4% would also be zero. But for the equivalent temperature in Fahrenheit (32°F) the adjustment would be $32 \times 0.04 = 1.3^\circ\text{F}$. And for 273°K it would be 10.9°K. I suggest the authors find a different way to express this adjustment, and in doing so also clarify its sign (e.g. by specifying that it is an increase). [David Wratt, New Zealand]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
50073	3	1	3	1	Footnote 4 does not specify which of GSAT or GMST is larger, and therefore it is unclear how to convert between the two - please could this be specified here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
64747	3	1	3	1	Footnote 4 : For more clarity, add « change » after « applied to GMST » and after « infer GSAT ». [Serge PLANTON, France]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
108531	3	1	3	1	In footnote 4 the value 4% is ambiguous since you're talking about temperature. Is this K, oC? Is this a subtracted difference in temperature? This needs to be explained better. One can't take 4% of oC unless it's a change in temperature, only an absolute temperature scale like Kelvin can do that. If you're doing a 4% difference in temperature, that's fine in oC, but that's not clear here. [Jason Donev, Canada]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
97167	3	1			Please include reference to {Glossary}. [Nicole Wilke, Germany]	Not applicable. Box removed from SPM.
42159	3	1			Footnote 4. GSAT & GMST: Is a correction also applied to anomalies or only absolute temps? [Tina Christensen, Denmark]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term ‘global surface temperature’ is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
11397	3	3	3	3	“Global Warming Levels” are explained with the term “Specific Warming Levels”. Choose one, it’s a bit confusing with two names for one thing. The Helix project which was early with this used “Specific Warming Levels (SWL)”. [Strandberg Gustav, Sweden]	Not applicable, box SPM.1 has been removed from revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44059	3	3	3	6	Why are there two reference periods while only the 1850-1900 one was used in AR5? How much of a difference does it make when the former is used rather than the latter? The temperature metrics used in AR5 are highly policy-relevant because they served as a basis to inform the drafting of the Paris Agreement, and have become part of it via the formulation of its Long-Term Temperature Goal. Therefore it is important to be able to keep track of progress towards that Goal by using the same "temperature language" as in AR5. If climate changes for some global warming levels need to be assessed with 1750 as a baseline, the underlying reasons need to be clarified and it must be as much as possible clarified as well how much of a difference that makes in comparison to an assessment using the 1850-1900 period as a baseline. [Lamin Mai Touray, Gambia]	Taken into account. Text now shows changes relative to 1850--1900 only.
12627	3	3	3	6	Two choices of pre-industrial baseline (1750 vs 1850-1900) is given here, could generate some confusion, especially when corresponding to Paires Agreement target, some explanation is needed. [Lijing Cheng, China]	Taken into account. Text now shows changes relative to 1850--1900 only.
3581	3	3	3	6	Please explain the reason why in AR6 authors has changed from GMST to GSAT. In 1.5SR SPM, GMST is explained as one of Core Concepts central to the report (p.26). Also it is important to make it clear that for the temperature targets in Paris agreement there is no definition nor agreement whether it means GMST or GSAT. [Mitsutsune Yamaguchi, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
89901	3	3			As stated above, we could find no value in using 1750 as a starting new baseline, when the 1850-1900 was previously used as an approximate for pre-industrial. Changing the baseline in our view will create confusion in terms of which pre industrial period are we comparing 1.5°C or 2.0°C warming levels, to. Furthermore, it is our view that moving the baseline to 1750 only elevates, already large uncertainties, with even poorer data. Why 1750 for instance? Why not 1720? [Joanne Deoraj, Trinidad and Tobago]	Taken into account. Text now shows changes relative to 1850--1900 only.
99967	3	3			The introduction of the 1750 baseline for 'pre-industrial' might appear confusing to policy makers as previous reports and the AR5 used 1850-1900. The Paris Agreement has been informed by this assessment under AR5. It might be worth mentioning that some human influence might be detectable before, but would recommend maintaining the previous established pre-industrial baseline 1850-1900 as the introduction of ambiguity is not helpful particularly on a formulation that relates directly to the Paris Agreement. [Caroline Eugene, Saint Lucia]	Taken into account. Text now shows changes relative to 1850--1900 only.
36017	3	3			It would be useful if you could estimate the difference between two reference periods. [Michael PRATHER, United States of America]	Taken into account. Text now shows changes relative to 1850--1900 only.
68789	3	3			The Paris Agreement as well as the AR5 have been informed by the period 1850-1900. Introducing the 1750 baseline for 'pre-industrial' can create ambiguity. [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Text now shows changes relative to 1850--1900 only.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78947	3	4	3	5	Why are there two "pre-industrial" reference periods for GSAT, with an additional reference time (1750)? Given that policymakers based their past decisions on the practical approximation of "pre-industrial" used up to AR5, ie. 1850-1900, what is the added value of using the additional reference, especially given that the uncertainty would still be much larger for a 1750 reference? [Martine Vanderstraeten, Belgium]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
97169	3	4	3	5	It is very important that the IPCC provides a clear definition of the "pre-industrial period". The current text lacks clarity (1750 vs 1850-1900, or 1750 "through the period" 1850-1900 as in SPM footnote 3) and its consequences including for temperature, concentration and budget, potentially drawing on the text of TS1.4. Please see also our comment on the Entire Report regarding the definition of the pre-industrial period. [Nicole Wilke, Germany]	Taken into account. Text now shows changes relative to 1850--1900 only.
107941	3	4	3	5	defining 1.5 and 2 C as *GSAT* relative to 1850-1900 is slightly inconsistent with the Structured Expert Dialogue which fed into the Paris Agreement -- that was based on AR5 assessed historical warming to the AR5 baseline period of 1986-2005 (based on GMSTobs) plus projected warming based on future changes in GSAT relative to the 1986-2005 period. So a blend of GMST and GSAT. Refer to a section of the report where the implications of this small inconsistency is assessed, ideally something in the TS not just a chapter. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
80065	3	4	3	5	The definitions of the reference periods are misleading. Earlier 1850-1900 was declared as pre-industrial. We suggest keeping this one. [Lilian Fejes, Hungary]	Taken into account. Text now shows changes relative to 1850--1900 only.
110765	3	5	3	6	impacts and emissions and concentration scenarios > impacts and emissions, and concentration... or impacts, emissions and concentration scenarios [cathy clerbaux, France]	Not applicable, box SPM.1 has been removed from revised draft.
97171	3	6	3	6	Please add Chapter 9. [Nicole Wilke, Germany]	Not applicable, box SPM.1 has been removed from revised draft.
80617	3	6	3	6	Suggest adding a reference to TS CC-Box 2 here, as it somewhat extends the discussion in the sections already referred to. (Or at least it will once it's complete.) [Bjorn Samset, Norway]	Not applicable, box SPM.1 has been removed from revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112773	3	8	3	9	The term "climate impact driver" is confusing. In WGII the word "impact" is reserved for observed/realised impacts, whereas the term "risk" would be used for potential future "impacts". I would strongly suggest reconsidering this -- either "climate impact/risk driver" or simply "climate driver". This also applies to the word (detrimental or beneficial) "impact" in this sentence -- this should also be conveying the difference between what is already observed and what could happen in the future (risks). Note that this reflected in some terms later in the SPM, e.g. the wording "impact- and risk-relevant climate change information" on page 7 line 22-23. This comment applies to the use of this term throughout the SPM and the entire report. [Maarten van Aalst, Netherlands]	Rejected. The Climatic Impact-Driver (CID) term is explained with a footnote 7. In addition, FAQ12.1 covers an introduction to CIDs.
112135	3	8	3	10	I'm very pleased to see this new terminology being included here. The definition looks good at first reading, with just one minor observation. To avoid possible ambiguity that these are climatic-impact drivers, which could of course include any driver of impacts, and not climatic impact-drivers, why not hyphenate the latter two words, as here? The glossary definition clarifies this meaning, but the casual reader may not appreciate it, whereas the hyphen would cause the reader to pause for thought. Hence, this hyphen constitutes a substance not editorial comment! [Timothy Carter, Finland]	Accepted. The term is hyphenated in the revised version 'Climatic impact-driver'.
17427	3	8	3	10	A couple of examples might aid clarity here. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, box SPM.1 has been removed from revised draft.
131647	3	8	3	10	definition should be in glossary to be picked up for X-WG use [Hans Poertner and WGII TSU, Germany]	Accepted. Definition is in the glossary
42383	3	8	3	10	In certain how this fits into the DPSIR framework. And the term is only used once in the SPM. [Tina Christensen, Denmark]	Taken into account. The Climatic-Impact Driver (CID) term is explained and used further in the next version of the SPM. The term is explained with a footnote (7).
69283	3	8	3	10	It would be useful for readers if examples of "climatic impact drivers" were included in Box SPM.1. [Kaoru Magosaki, Japan]	not applicable - box SPM.1 no longer exists in the revised SPM.
117189	3	8	3	10	definition of climatic impact drivers is not the same as in Cross Chapter Box 1.3 [Maisa Rojas, Chile]	not applicable - box SPM.1 no longer exists in the revised SPM.
65483	3	8	3	10	Suggest using the term "Impact drivers" to clarify that this includes climatic phenomena often referred to as "drivers" e.g. ENSO, PDO etc. [Kushla Munro, Australia]	not applicable - box SPM.1 no longer exists in the revised SPM.
40423	3	8	3	10	In other assessment processes, such as IPBES and MA, drivers are factors that, directly or indirectly, *cause* changes. Here "drivers" seem to be used to describe things such as temperature and precipitation that *results* from changes in the climate. I am concerned that this may lead to confusion particularly among policy makers and the general public. Perhaps change drivers -> effect, outcome or result. [TSU WGI, France]	not applicable - box SPM.1 no longer exists in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131979	3	8		10	The term climate impact driver is constraining the view on climate and I am wondering whether that is useful. A holistic view of the climate system has its own value and the term climate variable would be more appropriate here. While impacts can be positive or negative, the risk concept focuses on negative consequences and has thus successfully worked with the term hazard. The benefit of using CID is thus rather limited as its use is only fully justified if impacts assessment and detection and attribution have been carried out successfully by WGII. A vague "may" does not eliminate potential misunderstanding if the term is starting to be used routinely and in passing. Suggest dropping this term as constraining its use to verified cases will be challenging. The risk concept is already starting to be confused by this. The term CID being in the WGI glossary only does indicate the need for better coordination between WGs including leadership. If maintained it needs a qualifier such as "Potential CID". [Hans Poertner and WGII TSU, Germany]	Rejected. The Climatic Impact-Driver (CID) term is explained with a footnote 7. In addition, FAQ12.1 covers an introduction to CIDs. Only some CIDs will be relevant from the Risk framework., which is the mandate of WGII to assess, not WGI.
87131	3	8			The concept of Climatic Impact Drivers is a new addition to the AR6 cycle and we believe further and more detailed explanation is required for readers to fully understand. If it could be specified exactly why the term was introduced and whether it is being used to facilitate cross-WG assessment and if this term will be used across working groups. [Jacqueline Spence, Jamaica]	Taken into account. The Climatic-Impact Driver (CID) term is explained with a footnote 7. In addition, FAQ12.1 covers an introduction to CIDs.
99969	3	8			The Climatic Impact Drivers concept is a new feature of the AR6 cycle and would need a more thorough introduction. Please be more specific why this term is introduced. Is this an effort to facilitate the cross-WG assessment, in particular with WGII? Will this term be used across working groups? [Caroline Eugene, Saint Lucia]	Taken into account. The Climatic Impact-Driver (CID) term is explained with a footnote 7. In addition, FAQ12.1 covers an introduction to CIDs.
68791	3	8			The Climatic Impact Drivers concept is a new feature of the AR6 cycle and would need a more thorough introduction. [Jeffers Cheryl , Saint Kitts and Nevis]	not applicable - box SPM.1 no longer exists in the revised SPM.
88875	3	9	3	9	Consider using another word than 'hazards' as this brings about thoughts of gambling. [Thorsten Mauritsen, Sweden]	Not applicable, box SPM.1 has been removed from revised draft.
29381	3	10	3	10	add economy here [Joachim Fallmann, Germany]	Not applicable, box SPM.1 has been removed from revised draft.
17429	3	12	3	14	This statement is strong but perhaps meaningless without an accompanying explanation to say what it is. I guess that may not be easy to do. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, box SPM.1 has been removed from revised draft.
97173	3	12	3	14	Please describe also the risk framework itself, not only its purpose. [Nicole Wilke, Germany]	not applicable - box SPM.1 no longer exists in the revised SPM.
50071	3	12	3	14	Suggest this section on risk also includes a brief explanation of vulnerability and exposure. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	not applicable - box SPM.1 no longer exists in the revised SPM.
80619	3	12	3	14	This isn't a definition or an explanation, only a statement that a common framework has been used. For this box, I think the term "risk" needs to be defined (i.e. impact driver x vulnerability x exposure). [Bjorn Samset, Norway]	not applicable - box SPM.1 no longer exists in the revised SPM.
97175	3	14			Please include reference to {Glossary}. [Nicole Wilke, Germany]	not applicable - box SPM.1 no longer exists in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17425	3	16	3	18	Storylines: this makes sense but it is only referenced in this report twice (at A.3.4 and C.6.1) and in each case the information contained here does not seem to add value to what is written in the main text, so it does beg the question as to whether it is worth having this in here. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The revised draft no longer refers to storylines.
23321	3	16	3	18	I do understand the word-limit on this box, but also notice that the definition of "storyline" only includes what storylines can be used for, without giving a more general definition. Please consider to make use of the definition that was elaborated in collaboration between the three WGs during the SYR scoping meeting (and by subsequent involvement of WG1 storyline group): Storyline: A way of making sense of a situation or a series of events through the construction of a set of explanatory elements. Usually it is built on logical or causal reasoning. In climate research, the term storyline is used both in connection to scenarios as related to a future trajectory of the climate and human systems or to a weather or climate event. In this context, storylines can be used to describe plural, conditional possible futures or explanations of a current situation, in contrast to single, definitive futures or explanations. See "Scenario Storylines" and "Physical Climate Storylines" Scenario storyline: A narrative description of a scenario (or family of scenarios), highlighting the main scenario characteristics, relationships between key driving forces and the dynamics of their evolution. Physical climate storyline: A self-consistent and plausible unfolding of a physical trajectory of the climate system or a weather or climate event on time-scales from hours to multiple decades. Through this, storylines explore, illustrate and communicate uncertainties in the climate system response to forcing and in internal variability. [Anna Amelia Sörensson, Argentina]	Not applicable. Storyline is no longer mentioned in the revised SPM.
103979	3	16	3	18	The description should better explain the essence of the concept. The current text only mentions its uses, but not its essence. [Philippe Tulkens, Belgium]	Not applicable. Storyline is no longer mentioned in the revised SPM.
64819	3	16	3	18	It is not actually defined here what the storyline approach is. Could a short remark on this be added? [Lea Beusch, Switzerland]	Not applicable. Storyline is no longer mentioned in the revised SPM.
11573	3	16	3	18	This paragraph says what a storyline approach can be used for, but it does not say what a storyline approach actually is. I'm quite sure many readers do not know what that thing is. I just learned about this concept rather recently,for example. [Gerhard Krinner, France]	Not applicable. Storyline is no longer mentioned in the revised SPM.
131649	3	16	3	18	The definition of the storyline approach should give some additional information: Are you talking about a modelling approach here? Where in climate research is this approach used? Adding a little bit more context or an example here could help readers to better understand the approach. When I read your definition, I thought you meant some kind of storytelling, but I guess that is not the same, is it? [Hans Poertner and WGII TSU, Germany]	Not applicable. Storyline is no longer mentioned in the revised SPM.
112249	3	16	3	18	The entry for the "Storylines" states what this approach can be used for - but not what the approach actually is! Maybe there's a good example that can be provided in just one sentence to illustrate the approach? [Helge F. Goessling, Germany]	Not applicable. Storyline is no longer mentioned in the revised SPM.
110973	3	16	3	18	Storylines: this definition makes sense, but it is only referenced in this report twice (at A.3.4 and C.6.1) and in each case the information contained here does not seem to add value to what is written in the main text, so it does beg the question as to whether it is worth having this in here. [Monica Dean, United States of America]	Not applicable. Storyline is no longer mentioned in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97177	3	16	3	18	We do not support the "storyline" approach as presented, please see our related comments on the TS. But if kept, please describe also the storyline approach itself, not only its purpose. [Nicole Wilke, Germany]	Accepted. Storyline is no longer mentioned in the revised SPM.
69285	3	16	3	18	The description of storylines in BOX SPM.1 may be supplemented by incorporating as appropriate the definition given in the Glossary. In order to enhance the readability for the policymakers and the general readers, it may also be useful to provide some examples of this new storyline approach. [Kaoru Magosaki, Japan]	Not applicable. Storyline is no longer mentioned in the revised SPM.
129707	3	16	3	18	Is 'Storylines' the best way to present the idea of scenarios? It's an imprecise way to present this topic area/development. [Trigg Talley, United States of America]	Not applicable. Storyline is no longer mentioned in the revised SPM.
129709	3	16	3	18	Would policymakers understand what storylines mean? These sentences don't really explain what this approach is. Although one can refer to the cited text, it would be useful to add a sentence or two to briefly explain this approach for context. This is especially useful since previous IPCC reports talk about storylines in the context of developing socio-economic scenarios, which is very different from the storyline approach referred to here. [Trigg Talley, United States of America]	Accepted. Storyline is no longer mentioned in the revised SPM.
109285	3	16	3	18	To avoid definiing a term using that same term, how about "Storylines are narratives about possible internally consistent futures. They can be used..." [Paul Edwards, United States of America]	Not applicable. Storyline is no longer mentioned in the revised SPM.
80621	3	16	3	18	This shows how storylines are used, not what they are. Suggest adding a brief definition based on the glossary entry, as this term will be confusing to many. (It certainly has been to the authors while drafting the report...) [Bjorn Samset, Norway]	Not applicable. Storyline is no longer mentioned in the revised SPM.
111431	3	20	3	20	Remove "these are" [James Renwick, New Zealand]	Not applicable, box SPM.1 has been removed from revised draft.
9469	3	20	3	20	Check for consistency of phrasing throughout the document. Sometimes it is referred to as low probability, high impact events. [Joelle Joelle Gergis, Australia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
103981	3	20	3	21	Concrete example of low-likelihood, high impact events should be provided. [Philippe Tulkens, Belgium]	Not applicable, box SPM.1 has been removed from revised draft.
106059	3	20	3	21	Suggest including that these are physically plausible to make it clear that these are not erroneous model outliers that defy the laws of physics.: "These are physically plausible events..." [William Gutowski, United States of America]	Not applicable: Reference to "plausible events" has been removed in the revised text following other review comments to sharpen the text.
131651	3	20	3	24	Listing one or two examples of a low-likelihood, high-impact event would be very helpful here, because readers need a picture in mind if you want them to understand such difficult and abstract concepts or technical terms. [Hans Poertner and WGII TSU, Germany]	Not applicable, box SPM.1 has been removed from revised draft.
97179	3	20	3	24	According to the glossary the expression "low-likelihood, high impact events" is not consistent with the IPCC's definitions of "impact" and "risk". The likelihood of any impact would be one, as it is per definition a "realized risk". We assume that you refer to a CID, not to impacts, hence "low-likelihood, high risk events" would not make sense and the expression should be changed to "low-likelihood, high climate impact driver events". But this seems strange as well. Please clarify and see also our comment on the Entire Report regarding the definitions of risk/impact in the glossary. [Nicole Wilke, Germany]	Taken into account. We have tried to clarify the meaning of low-likelihood high impact outcomes, rather than impacts, in HS.12.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97181	3	20	3	24	We do not support the concept of "low-likelihood, high-impact events" as presented, please see our related comments on the TS. But if kept, the description needs to be improved please and clarify that this is related to CMIP6 models that are warmer than suggested by other lines of evidence. [Nicole Wilke, Germany]	Taken into account: We keep this paragraph as its importance is emphasized by other reviewers. We have rewritten bullets 1 and 2 to clarify what low likelihood refers to in the AR6 WG1 and section context.
69287	3	20	3	24	It would be useful for readers if examples of "low-likelihood, high impact events" were introduced in Box SPM.1. [Kaoru Magosaki, Japan]	Not applicable, box SPM.1 has been removed from revised draft.
36019	3	20			Like 'low-likelihood' I would also hyphenate 'high-impact' -they are in parallel. [Michael PRATHER, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
27675	3	21	3	23	The sentence starting after the comma ("such low-likelihood") is unclear and should be reformulated. [Eric Brun, France]	Not applicable, box SPM.1 has been removed from revised draft.
107943	3	23	3	23	"greatest risks might not be associated with" could be more firmly expressed as "greatest risks are not associated with" because this is a firmly established finding. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, box SPM.1 has been removed from revised draft.
53445	3	23	3	24	May need an enhanced coordination and a more systematic approach across WG1 chapters? [Hervé Douville, France]	Noted.
9535	3	24	30	24	Specify what is meant by 'similar sectors' so it's clear to the reader. Give an example or delete. [Joelle Joelle Gergis, Australia]	Not applicable, box SPM.1 has been removed from revised draft.
37203	3	26	3	30	You repeat the old and fallacious IPCC claim. The ENSO and other oscillations are almost certainly caused by the oceans transporting heat and that heat comes from the sun, which of course is an external forcing rather than internal variability. [John McLean, Australia]	not applicable - box SPM.1 no longer exists in the revised SPM.
24405	3	26	3	30	Should explain internal and natural variability more clearly. Here, does the natural variability include internal variability? Generally, internal variability refers to the climate system [Zhou Botao, China]	not applicable - box SPM.1 no longer exists in the revised SPM.
97183	3	26	3	30	We suggest deleting this paragraph since the expression in bold is self-explanatory, in doubt one could use the glossary. [Nicole Wilke, Germany]	Accepted. Box no longer exists in the revised SPM.
66923	3	26			I'm not sure this definition of the distinction between internal and natural variability will be clear to a general audience. For the SPM, is it even necessary to make this distinction? If so, suggest re-wording. [Mathew Barlow, United States of America]	not applicable - box SPM.1 no longer exists in the revised SPM.
80391	3	27	3	27	It should be "El Niño", not "El Nino" [Paola Arias, Colombia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
129711	3	27	3	27	The term "radiative forcing" needs to be explained in the Summary for Policymakers. [Trigg Talley, United States of America]	not applicable - box SPM.1 no longer exists in the revised SPM.
129713	3	27	3	27	Replace "Nino" by Niño". [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
26335	3	27	3	27	El Nino-> El Niño [María Santolaria-Otín, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
104705	3	27			"what about very briefly explaining the concept of Radiative Forcing? Policy makers could not be very familiar with that concept, it is not so simple for a non expert" [Andrea Bianchi, Italy]	Not applicable, box SPM.1 has been removed from revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
15365	3	30	3	30	There are a lot of sections are referred to. It is not clear in what sense these sections are related to this topic of "Internal and natural variability". [Masaki Satoh, Japan]	not applicable - box SPM.1 no longer exists in the revised SPM.
15029	3	30	3	30	This is an example of cross-reference clutter that riddles the 'Summary' (actually it is more of a précis). There are further examples on almost every page. The likelihood of a policymaker looking all of these up is negligible. Advisers, staffers etc who need depth can address the full report without the need for these links. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. The line of sights are essential for the traceability of the SPM to the underlying chapter. Their presence is mandatory.
131653	3	31	3	34	and footnote: the definition of global warming in the glossary uses GMST and averaged over 30 year periods - is this definition of global warming consistent with the SPM use of GSAT? [Hans Poertner and WGII TSU, Germany]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
112137	3	32	3	37	I suppose that there has been cross-WG discussion on the glossary, because this term may also appear in WG II and WG III in different contexts. I can think of emergent risk, for example, as well as emergent technology, to name but two examples. It's less likely that the definition of those terms can be couched in such precise statistical language as here. [Timothy Carter, Finland]	not applicable - box SPM.1 no longer exists in the revised SPM.
11575	3	32	3	37	The term "emergence" also appears in the concept of "emergent constraints" in the report (though not in the SPM), where it takes a different meaning (linked to behaviours or characteristics of complex systems that are not immediately inducible from an analysis of the underlying processes or equations ("epistemologically opaque")). Defining emergence here only in the sense related to climate change signal detection can induce confusion. [Gerhard Krinner, France]	Not applicable, box SPM.1 has been removed from revised draft.
131655	3	32	3	37	emergence not in the glossary although time to emergence is (and directs reader to emergence) [Hans Poertner and WGII TSU, Germany]	Accepted. The word has been added to the glossary.
42161	3	32	3	37	Emergence: Add explanation. "Emergence is a term used to explain ..." + clarify why this term is needed. [Tina Christensen, Denmark]	not applicable - box SPM.1 no longer exists in the revised SPM.
20921	3	32	3	37	The use of the term emergence is somehow confusing, especially in line 34 where it say emergence can refer to changes relative to a historical baseline. So how does it differs from the normal climate change which is also compared to historical baseline [Ladislav Chang'a, United Republic of Tanzania]	Taken into account. Box SPM.1 has been removed from the revised draft.
80067	3	32	3	37	Some definitions could be revised: noise consists of more than just the natural variability in climate change signals; while the signal-to-noise ratio is a different measure and as such we call the ratio of signal to natural variability expressed in years the time of emergence. For example Szabó and Szépszó, 2016 refers to these definitions. Furthermore, it is called emergence since it urges policymakers to act, that it is an "emergency". [Lilian Fejes, Hungary]	Taken into account. Box SPM.1 has been removed from the revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65485	3	32	3	37	Suggest reconsidering use of the term "emergence". It is used here and elsewhere in the SPM. This is a phenomenon that is important to scientists, but it won't mean much to policymakers. Also, major risks occur prior to emergence. Suggest reducing the emphasis given to emergence. Regarding the term "emergence" itself, it is not a very useful term, as it gives the impression that it is a passive process - and it isn't. It is a forced process, a process driven by human-driven emissions. Suggest using a more appropriate term such as "expulsion" (Power 2014; Nature). [Kushla Munro, Australia]	Taken into account. Box SPM.1 has been removed from the revised draft.
108533	3	32	3	37	Emergence of the climate signal doesn't have an entry in the glossary [Jason Donev, Canada]	Taken into account. Emergence now features in the glossary.
36021	3	32			I would have thought 'natural' was 'internal', they are certainly not 'or'. What I think you are after is 'forced/natural' and 'unforced/internal'. [Michael PRATHER, United States of America]	Not applicable, box SPM.1 has been removed from revised draft.
109287	3	34	3	34	Since you have just told us that emergence is defined as the point where signal exceeds noise, it's confusing to then read "emergence occurs at a defined threshold of this ratio." It's also unclear what "a threshold of a ratio" might mean. I suggest deleting that phrase. [Paul Edwards, United States of America]	Not applicable, box SPM.1 has been removed from revised draft.
111087	3	38			preamble ending here is very useful but might invite lengthy discussion in plenary [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
90719	3	42	3	42	Footnote 4: Given the extremely high relevance of the substitution of the GMST by the GSAT in this report, it is suggested that Footnote 4 be rewritten as follows: "Numerous observational datasets exist for GMST (Section 2.3.1.1), although until recently many had substantial gaps in global coverage. There is, however, currently no regularly updated entirely observational dataset for GSAT. Therefore, recourse to model-based evidence is required to estimate the difference between observed GMST estimates and GSAT estimates and their respective warming rates. There is high confidence that GMST and GSAT differ and an inflation of 4% (2-7%) is required to be applied to GMST estimates and their range to infer GSAT equivalent estimates {Cross-Chapter Box 2.3}." [José Romero, Switzerland]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
64817	3		3		The number for the difference between GSAT and GMST is highly dependent on processing choices in deriving GMST (see recent CMIP6 analysis in supporting information of Beusch et al 2020 (https://doi.org/10.1029/2019GL086812 , Fig S2) and CMIP5 analysis in Cowtan et al 2015 (https://doi.org/10.1002/2015GL064888)). Hence, I think it is problematic to give this value range in the SPM (especially because it does not contain the 9-10% difference observed when blending anomalies instead of absolute values in GMST (and allowing sea ice fraction to change with time) which is arguably closest to some observational products such as BEST). [Lea Beusch, Switzerland]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
26165	3		3		Footnote: It would be nice to explain the difference between the definitions of GMST and GSAT very briefly here (although in Cross-Chapter Box 2.3). [Toshihiko Takemura, Japan]	Taken into account. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
116069	3		3		The definition of emergence differs from the one in the glossary which is explicit on human induced change. Explain clearly what is meant in this report by human induced change. [Valerie Masson-Delmotte, France]	not applicable - box SPM.1 no longer exists in the revised SPM.
116071	3		3		Check definition of storylines here, use in the report, definition in the glossary ("physical climate storyline") to improve consistency. [Valerie Masson-Delmotte, France]	not applicable - box SPM.1 no longer exists in the revised SPM.
114917	3		3		Footnote 4: Suggest to make clear that the adjustment consists in an increase of GMST to infer GSAT. [Elmar Kriegler, Germany]	Taken into account Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
104359	3				In footnote 4 it is not clear what the % refers to. % of what? [Finnveden Göran, Sweden]	not applicable - box SPM.1 no longer exists in the revised SPM.
12629	4	1	4	3	The structure of SPM seem not very logical to me: A is to understand the emergence of human-induced climate change, but the "human-induced climate change" is actually introduced afterward in B. So lots of SPM-A contexts is losing their ground. I would suggest to put A after B. So the order of SPM can be: B (what was changed). A (why). C (future). D (Limiting climate change) [Lijing Cheng, China]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
86893	4	1	7	48	Section A seems as a detour from the core topic. We agree that there is a need for self-awareness of the evidence base (A.1.), the various scales to take into account (A.2.) and for integrated knowledge (A.3.). However, the information in these chapters is vague and not to the point. It seems more relevant to put this information in text boxes. [Oyvind Christophersen, Norway]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86457	4	1	7	52	Section A should rather be a framing section. Sections A2 and A3 could be deleted - they don't add much to SPM and some of this information is repeated elsewhere. Section A could be used to provide long-term perspective of paleo data with high and very high confidence, some of which is currently not in SPM. These statements will help the reader understand how unprecedented the changes are that we observe due to climate change today. [Ala Taimar, Estonia]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
110767	4	2	4	2	Undersnad... communicate... [cathy clerbaux, France]	not applicable. The structure of the SPM is changed completely.
88877	4	2	4	3	I suggest removing 'and communicating information' [Thorsten Mauritsen, Sweden]	not applicable. The structure of the SPM is changed completely.
87893	4	2	4	3	should come after chapters B and C and should be reduced to no more than one page [John Carstensen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
27735	4	2	4	3	Regarding our proposal to delete A.2 and A.3, we suggest to delete this title as well. [Eric Brun, France]	Not applicable. We removed the titles for the headline statements.
44689	4	2	4	3	Suggest focusing the section on the "Understanding human-induced climate change" or suchlike. "Emerging" would seem to be misleading (a significant change is already about), and the "communication" as a process would seem to be out of scope and also rather little addressed in A. [Markku Rummukainen, Sweden]	Not applicable. SOD-section A removed from SPM, with the most important information integrated in the revised section 'state of the climate'.
108987	4	2	4	3	The introduction says "understanding climate change" and here understanding the *emergence* of human-induced climate change [Gemma Teresa Narisma, Philippines]	not applicable. The structure of the SPM is changed completely.
111621	4	2	5	53	I wasn't sure what this section is trying to achieve. It seems part historical perspective, part quick climate tutorial, part summary of progress since AR5. Could the section be shortened? Some of the material on communication might fit better in Section D.5, and I would suggest that Section A focuses on summarising key areas of progress since AR5. The rest of the SPM necessarily contains a lot of valuable updates on detail, but a pointer to the key areas of qualitative progress would be a useful introduction. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
41997	4	2	7	48	Section A deals a lot about methodological aspects. It would be more beneficial for readability of the SPM if the first sections would address substance questions. The authors could consider moving it to the end of the SPM or alternatively shorten and merge the subsections. [Juhani Damski, Finland]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
81941	4	2	7	48	Appreciate the accessible and largely non-quantitative language of Part A. [Dan Zwartz, New Zealand]	noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81035	4	2	7	48	I found section A being a bit of a distraction for what the SPM is intends to do, to enable a quick access to the top highlights of the report. It is good background but the reader is left waiting for the real reason he/she came to the SPM and not to any other of the documents we produce. Perhaps the material is better suited for the TS. Any cricial content could be moved to section B to provide context when highlgiths are presented. [canadell pep, Australia]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
44061	4	2	7	52	Section A could be shortened as some of the climate changes it mentions are described in more detail in further sections. Moreover, the purpose of Section A3 is not clearly identifiable as it seems to mix statements on changes in climate impact drivers and on climate change communication. [Lamin Mai Touray, Gambia]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
90723	4	2	8	47	Section A is interesting, but it is questionable whether it is appropriate to have it in the SPM.It contains little quantitative material and presents a discussion of general concepts and historical developments that are, admittedly, useful to the reader, but it does not focus on the new information and updated knowledge that is expected in an SPM of any new IPCC assessment report. Therefore, would it be possible to consider deleting Section A and distributing the few relevant quantitative elements from Section A in the other sections? Furthermore, since the SPM is already quite long, without Section A it would be shorter and easier to read. [José Romero, Switzerland]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
108991	4	2			The section heading seems to be a bit disjoint to the subsections/subsection headings, or the flow is not quite "connected". The ssection heading also has communicating information whiile the content in the section refers more to integrated knowledge. [Gemma Teresa Narisma, Philippines]	Not applicable. SOD-section A removed from SPM.
87311	4	5	4	5	change science into change as the lines of evidence relate to cc, not climate science [Marcel Berk, Netherlands]	Not applicable. SOD-section A removed from SPM.
76871	4	5	4	5	Preamble may be reconsidered in the context of a revised SPM. I [Emer Griffin, Ireland]	Accepted. SPM structure (and therefore preamble) completely revised
90721	4	5	4	5	Delete the word "Preamble" because it introduces an essential ambiguity in the SPM. For policymakers, the word Preamble in a document means that it is not an "operative" or "executive" part of the document, and therefore that it can be treated as a "nice to have" but not a necessary part of the document. On the other hand, SPM is, by definition, a document where every statement has a high scientific content and nothing is "preambular" in nature. All SPM is "operational" or "executive" and nothing is preambular. [José Romero, Switzerland]	Accepted. 'Preamble' removed from section introductions.
23345	4	5	4	8	Since this opening sentence applies to the entire SPM, not just to section A, it could be lifted to the Introduction of the SPM (that starts at p2, l1). [Anna Amelia Sörensson, Argentina]	Not applicable. SOD-section A removed from SPM.
17433	4	5	4	13	Shouldn't this 'PREAMBLE' go in the Introduction (SPM-2) not here? Most of this box seems to refer to content that appears before Section A. It therefore follows that Section A needs its own preamble. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. SOD-section A removed from SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54579	4	5	4	13	Overall, we think this preamble for section A could be stronger and more clearly capture the contents of all 3 subsections. Missing from the preamble are statements telling readers that Section A presents the evidence base for human influence on the climate system, for emergence of signals of change regionally, and key advancements in research and understanding since the AR5. [Nancy Hamzawi, Canada]	Not applicable, the SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
87151	4	5	4	13	Please consider to also include some text about the link between observed changes and attribution to human influence in this preambular para/box. [Oyvind Christophersen, Norway]	Not applicable. SOD-section A removed from SPM.
5255	4	5	4	13	This preamble is another distraction before we get to the meat of the report. Delete it. I know that sounds a little strong, but it is so important to get readers into the SPM into the meat of the SPM as soon as possible. [Daniel Murphy, United States of America]	Not applicable. SOD-section A removed from SPM.
108175	4	5	4	13	While the preamble does a good job of setting the stage, it introduces the concept of risk. Risk is a difficult concept for most people to understand, particularly those who may not have scientific training (the majority of policymakers). However, nowhere does the body of this summary clearly and effectively define the concept of risk to people. How will policymakers be able to explain concepts of risk to their citizens, if it is not clearly explained to them first? [Anton Holland, Canada]	Taken into account. Although Risk assessment is the mandate of WGII, WGI provide physical climate related information that may be relevant for risk assessment, primarily through the framework of climatic impact-drivers. The risk concept is discussed where relevant in this context in the FGD SPM. Note that due to space limitations, the thorough introduction to Risk is found in the Technical Summary and Chapter 1.
45205	4	5	4	13	The Preamble needs to be improved to better reflect the essence of Part-A i.e., 'Understanding the emergence of human-induced climate change and communicating information'. The "human influence" on climate and "communication of information" are not adequately reflected in the Preamble. [Krishnan Raghavan, India]	Not applicable. SOD-section A removed from SPM.
42163	4	5	4	13	A Preamble: unclear whether this is preamble for entire SPM or section A. E.g. Atlas introduction. [Tina Christensen, Denmark]	Taken into account. Section introductions are no longer called preambles and no longer appear in boxes. The text is just italicised. Hopefully it is now clearer that the text only refers to the section it introduces.
86459	4	5	4	13	This green Preamble box is not needed here and also not for the other sections. The points made here belong to the introduction above. Also, section A is not really an introduction. It is already a part of SPM of the WGI contribution to AR6. Deleting it would help shorten the report. [Ala Taimar, Estonia]	Taken into account. Section introductions are no longer called preambles and no longer appear in boxes. The text is just italicised. Hopefully it is now clearer that the text only refers to the section it introduces.
66509	4	5	4	13	The innovations regarding previous reports are not visible enough in this preamble, except for online Atlas; Proposition to add: Also, the AR6 is designed to have an increased policy relevance by detailign climate change at the regional scale, relevant for impacts. [robert vautard, France]	Not applicable. Section completely restructured and revised.
93603	4	5			"... understanding of climate CHANGE science", not climate science [Jean-Louis Dufresne, France]	Editorial. Climate science includes climatic changes.
53447	4	5			replace "climate science" by "the climate system and climate change"? [Hervé Douville, France]	Editorial. Climate science encompasses the climate system and climatic changes.
81935	4	8	4	8	Does "This introduction" refer to Part A, or the previous Introduction section? [Dan Zwartz, New Zealand]	Taken into account. Section introductions are no longer called preambles and no longer appear in boxes. The text is just italicised. Hopefully it is now clearer that the text only refers to the section it introduces.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23347	4	8	4	8	"This introduction focuses on..." - from the Introduction of the SPM (that starts at p2, l1), my understanding was that Section A is not an introduction, but a section that follows the Introduction. It is a bit confusing to call A introduction since the SPM already has an Introduction. [Anna Amelia Sörensson, Argentina]	Accepted. The word 'introduction' now only features in the heading of overall introduction of the SPM.
19535	4	8	4	8	What is meant by "this introduction"? In case you are talking about section A1, it is best to spell it. [philippe waldteufel, France]	Accepted. The word 'introduction' now only features in the heading of overall introduction of the SPM.
87445	4	8	4	8	Hyphenate 'evidence-base'? [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
89641	4	9	4	9	The introduction is not just about regional climate - this should read ""global and regional climate" [Trude Storelvmo, Norway]	Not applicable. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change the information from the SOD-section A has been integrated in the new SPM.
53449	4	9			replace "new" by "new or more accurate"? [Hervé Douville, France]	Not applicable. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change the information from the SOD-section A has been integrated in the new SPM.
81937	4	10	4	10	Text says "...with a particular focus on risk..." but risk is not mentioned again in the SPM (only in Box SPM.1) [Dan Zwartz, New Zealand]	Taken into account. The 3rd section of the revised SPM is now focusing on Climate Information for Risk Assessment and Regional Adaptation
66511	4	10	4	10	between "risk" and ", and plausible events..." one also could add intermediate features and say "risk, climatic impact drivers, and plausible..." [robert vautard, France]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
65491	4	10	4	10	Suggest clarification. The text states "...with a particular focus on risk..." but risk is not mentioned again in the SPM (only in Box SPM.1) [Kushla Munro, Australia]	Taken into account. The 3rd section of the revised SPM is now focusing on Climate Information for Risk Assessment and Regional Adaptation
23327	4	10	4	11	"...a particular focus on risk, and plausible events that would have a high impact but are uncertain in their chance of occurrence." I think you mean "low-likelihood, high impact events" so this could be easier to understand if the language is streamlined with the Box SPM.1: "...a particular focus on risk and low-likelihood, high impact events." Linguistical diversity can be confusing at this level of synthesis I think. If instead you don't mean low-likelihood, high impact events but something else, then the text should be written so that the distinction is clear. [Anna Amelia Sörensson, Argentina]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87447	4	11	4	11	Or: 'but whose chance of occurrence is uncertain'? [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
25719	4	11	4	12	It should be added when tackling "plausible events that would have a high impact but are uncertain" that these events have a low likelihood. [Don Alfonso Pino Maeso, Spain]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
14549	4	11	4	13	Ch 12 is also new in WGI. Worth a mention here under "innovations"? [Roshanka Ranasinghe, Netherlands]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
103983	4	12	4	12	Mention who is the targetted audience for this Atlas. [Philippe Tulkens, Belgium]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
101499	4	12			Change "report is the Atlas which includes" to "report is the Atlas, which includes" [Knut Nadelhoffer, United States of America]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific sentence no longer exists.
23323	4	16	4	17	The title of A.1: "Evidence base about how and why the Earth's climate varies naturally, and is responding to human perturbations" can be improved. In its current form it is not clear that the "how and why" also applies to the second part of the sentence "is responding to human perturbations". Easy fix would be "Evidence base about how and why the Earth's climate varies naturally, and about how and why it is responding to human perturbations", but giving it a bit more thought I am sure we can come up with something better. [Anna Amelia Sörensson, Argentina]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific title no longer exists.
27681	4	16	4	17	This title is very long: we propose to rename it "Evidence about Earth's climate natural variability and its response to human perturbations". [Eric Brun, France]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific title no longer exists.
88879	4	16	4	17	The title says 'and is responding to human perturbations', but there is not much in the section that speaks to this point. I suggest moving C.1.6 about ECS and TCR, and possibly also C.1.7 which speaks to A.1.5, to this section. [Thorsten Mauritsen, Sweden]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections. As a result, this specific title no longer exists.
131657	4	16	4	17	The term "human perturbations" is confusing. I did not find it in the Glossary and as a reader do not know what is meant by it. Alternatively: human influence, activity or human-driven change? [Hans Poertner and WGII TSU, Germany]	Taken into account. The term does not feature in the revised SPM.
87449	4	16	4	17	Hyphenate 'evidence-base'? The title is ungainly and a bit hard to follow. Possibly: 'Evidence-base regarding the natural variability of the earth's climate and its responsiveness to human perturbations.' [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
76873	4	16	4	25	The key driver of climate change is the changes to the Earth's energy balance. This concept should be included here otherwise the text is quite obscure [Emer Griffin, Ireland]	Rejected. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate", as a result we do not see the need to mention the energy balance/budget, which is covered in HS4.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
103985	4	16	5	24	Section A1 is too long. From a policymaker perspective its main function should be to build confidence in the robustness of the overall report by stating that the evidence base is solid, and that anthropogenic causes of climate change have been thoroughly checked against other possible explanations. The section should include the minimum text necessary to make these points so as not to detract from the findings themselves, which come in the subsequent sections. [Philippe Tulkens, Belgium]	Not applicable. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change As a result, the SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
42169	4	16	5	24	A.1 can be shortened - but important remarks should be kept! [Tina Christensen, Denmark]	Taken into account. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
50075	4	16	5	25	This whole section A1 is too long and focuses on a lot of technical information that is better suited to the Technical Summary. Currently, there's too much information on methodologies, which is less relevant to policymakers. Furthermore, this information is obscuring the key messages on attribution and what all these improvements in data/observations have told us. Suggest this whole section is looked at again and focuses on: 1. the attribution statement on human influence on warming; 2. a short paragraph summarising that our confidence has increased because of better observations, models etc./multiple lines of evidence; 3. observations have shown us unequivocally that changes are occurring. The headline statement should also focus on implications of better knowledge rather than a summary of the ways in which knowledge has improved. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
129715	4	16	5	52	[ACCESSIBILITY] The A1 key message is an attempt to summarize the history of climate science, which does not help with framing and does not contain new messages about climate change. It could be deleted to reduce the SPM length. [Trigg Talley, United States of America]	Taken into account. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
105571	4	16	5	53	Section A.1 gives lots of excellent evidence about how our knowledge of climate change has increased. It could give an impression that everything we need to know is known. There are still many knowledge gaps however. Perhaps an additional point could be added here to highlight the main knowledge gaps or perhaps a signpost to the knowledge gap section of the main report could be added? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	not applicable - HS1 no longer exists in the revised SPM.
44687	4	16	7	48	Section A could be a candidate for considerable shortening. Discussion of the history of climate science and suchlike would not seem to be needed in an SPM. The primary content to retain is the material that addresses attribution (A1.6, some of A2), which may be feasible to integrate in Section B. Major methodological advances (A1.3-A1.5) that underline improved knowledge base could in turn be condensed into one bullet. The same applies to internal variability's role in determining changes and trends. The issue is relevant, but the heart of it could be written down more to pointm with more detail available in the underlying chapters. [Markku Rummukainen, Sweden]	Taken into account. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90167	4	16	7	52	We consider that the current section A is generally too theoretical for policy-makers and can be entirely dropped. We would from this section only like to keep the message "Due to multiple independent lines of evidence, human influence on the climate system since the mid-20th century is now an established fact." [Georges Gehl, Luxembourg]	Taken into account. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
5253	4	16			general about this section: In my subsequent comments I will almost always try to suggest shortening rather than new material. I know there is a struggle to keep the SPM short. [Daniel Murphy, United States of America]	Noted. Thank you, the revised SPM has been significantly shortened.
131659	4	17	4	24	A1.6 should be A1.1 or even the headline statement [Hans Poertner and WGII TSU, Germany]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
17431	4	17			The word 'perturbations' isn't in common use. Can 'disruption' or 'disturbance' be used instead? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this part of the SPM has been removed.
110975	4	17			The word 'perturbations' isn't commonly used, and could provide confusion to a general audience. Can 'disruption' or 'disturbance' be used instead? [Monica Dean, United States of America]	Not applicable, this part of the SPM has been removed.
67639	4	19	4	19	"Several centruies" is excessive. You might be able to get away with "three centuries". [Karen Rosenlof, United States of America]	Not applicable, text completely rewritten and sentence no longer appears.
44691	4	19	4	19	"increased" can be easily misunderstood, as it does not really express that there is a sizeable body of knowledge. Perhaps something like "The collected understanding of... is based on several centuries of climate science..."- [Markku Rummukainen, Sweden]	Taken into account: revised SPM talks of 'improved knowledge' (HS4.4)
110769	4	19	4	19	Several centuries, maybe a bit too much? [cathy clerbaux, France]	Not applicable, sentence removed.
76875	4	19	4	20	Example of above human perturbations of what? It also responds to other perturbations as discussed later. [Emer Griffin, Ireland]	Not applicable, text completely rewritten and sentence no longer appears.
115281	4	19	4	20	Curious opening sentence "Several centuries of climate science research have increased knowledge ..". Beyond Arrhenius, I don't think this report is influenced by science insights from two cenhturies ago. It is also not clear how science from two centuries ago is the result of higher quality observations, improved climate models climate models etc (cited in the following sentence) [booth ben, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, text completely rewritten and sentence no longer appears.
87239	4	19	4	20	"Several centuries of climate science research" is exagerated. One could state that knowlegde of the greenhouse effect and meteorology originates in the 19th century hence more than a century of research, Knowledge about how Earth' climate varies naturally and how it responds to human perturbations is at most one century old. This may provoke criticism which moves away the attention to the policy relevant content of AR6. We strongly recommend to skip this sentence. [Marcel Berk, Netherlands]	Accepted, sentence removed.
65017	4	19	4	21	"more" and "higher quality" etc. than what was available before the "several centuries"? [Johannes Quaas, Germany]	Not applicable, sentence removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23325	4	19	4	22	There is a mismatch between these two sentences: the first sentence talks about the climate research that has been going on for "Several centuries", while next sentence picks up "These advances..." (referring back to the the research carried out for "several centuries") and then listing items of which some are clearly very recently advances in this perspective, such as "development of more comprehensive climate models". So this can be fixed by re writing. I think that the latter sentence even should aim to speak about the advances only since AR5. [Anna Amelia Sörensson, Argentina]	Taken into account 'several centuries' no longer mentioned (in the introduction of section 'current state of the climate').
27677	4	19	4	24	<p>The first sentence of the headbox is quite interesting from an epistemological point of view but it increases the length of the SPM which is already too long. We are not convinced by its relevance in a SPM. We also think that the third sentence is a key finding of AR6 WG1, that is very relevant for this box. It could be moved to the beginning of the box. We recommend to delete the first sentence of the headline, and replace it by the third sentence. The box has to be reformulated accordingly.</p> <p>Also, in order to emphasize the message of the third sentence, we suggest to reformulate it. Our proposition for the box is the following: "Due to multiple independent and growing lines of evidence, human-induced perturbations of the climate system since the mid-20th century is now an established fact. The advances of the knowledge about Earth's climate are the result of more and higher quality observations, expanded information about past climates, improvements in theoretical understanding, and the development of more comprehensive climate models." [Eric Brun, France]</p>	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
5257	4	19	4	24	The strong conclusion in the last sentence is buried after some professorial text about centuries of research. Instead, start with strength and don't be academic. I suggest "Human influence on the climate system since the mid-20th century is now an established fact. There are multiple independent lines of evidence: higher quality observations, expanded information about past climates, improvements in theoretical understanding, and the development of more comprehensive climate models. (Figure SPM.1, Figure SPM.2)." Having the "established fact" sentence as the first sentence in the first red box would give it the emphasis it deserves. [Daniel Murphy, United States of America]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
41999	4	19	4	25	Is it possible to start with the last sentence "Due to these multiple independent lines of evidence, human influence on the climate system since the mid-20th century is now an established fact"? This would bring the important message into the beginning of the headline statement. [Juhani Damski, Finland]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
27679	4	19	4	25	Paragraph A1.1 is quite interesting from an epistemological point of view but it increases the length of the SPM which is already too long. We are not convinced by its relevance in a SPM. We recommend to delete the full A1.1. [Eric Brun, France]	Accepted. Bullet point removed from revised SPM.
103987	4	19	4	25	Start with the main point of the statement; "Human influence on the climate system is now an established fact", the rest of the statement is justification and context. [Philippe Tulkens, Belgium]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54581	4	19	4	25	In general, as the very first headline statement for this SPM, this one lacks punch. While the fact that the evidence base has strengthened is important to convey, it need not be at the start of the headline or even in the headline. Better to use the headline to emphasize key conclusions. One that could be brought up from the subsection below is the unprecedented nature of current climate change. [Nancy Hamzawi, Canada]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". The strengthening of evidence is now mentioned in the introduction of the 1st section and the unprecedented nature of the changes are the focus of HS2.
131661	4	19	4	25	The last sentence should be first as this is the key message (but swap the first and second half of the sentence) [Hans Poertner and WGII TSU, Germany]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
76879	4	19	4	25	This high level message can be shorter and clearer. What do policy makers need to know? [Emer Griffin, Ireland]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
24407	4	19	4	25	The anthropogenic influence is emphasized here. However, no details about the key progress and conclusion, which are suggested to be added. [Zhou Botao, China]	Rejected. The headline statement has been shortened and made snappier, rather than expanded. Key improvements are however briefly mentioned in the introduction of section 'current state of the climate'.
86895	4	19	4	25	This highlighted conclusion is well formulated, and very useful for policymakers. Its gives a plausible rationale for why the statement regarding human influence is now even stronger than in earlier assessments. However, you should consider to provide some sort of magnitude or semi-quantitatively measure on how much human activities has contributed. In the last sentence, you should consider adding "... established fact, and are without doubt the dominant feature that are currently altering the global climate system. [Oyvind Christophersen, Norway]	Noted. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". Quantifications of the human influence are now provided explicitly (e.g. HS1.2) or implicitly with uncertainty language and the use of 'main driver', defined in footnote 9 as meaning 'responsible for more than 50% of the change.
9597	4	19	4	25	I felt this was a poor start for the SPM. Why do AR6 on top of AR5 if the basis for this report is the several centuries of climate science research? You could start with the last sentence of the paragraph, and then explain where it comes from. [Olivier Boucher, France]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
5259	4	19	4	25	Here and elsewhere, the red boxes duplicate the bullet points. The purpose of the red boxes should be so a less technical person could scan through the red boxes and get the highlights without IPCC jargon. For each red box pick the two most important messages from that section and put them in plain language. [Daniel Murphy, United States of America]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets.
5261	4	19	4	25	I would also suggest that the references be removed from the red boxes (I see that AR5 put the references in a tiny, tiny font in their equivalent of the red boxes). In the spirit of plain language minimize the use of {xxx confidence} in the red boxes but instead put confidence into the words whenever possible. [Daniel Murphy, United States of America]	References: rejected. Traceability of each statement supporting the SPM is key and we are following past practices (see SR1.5). Confidence: accepted. IPCC uncertainty language is now avoided in the headline statements
5263	4	19	4	25	Suggestion for the most important points of this section: "The Earth's climate has changed. The atmosphere and ocean have warmed, ice and glacier mass has diminished, sea levels have risen, patterns of precipitation and extreme weather have changed, ocean pH has declined, and greenhouse gas concentrations in the atmosphere have increased. Multiple independent lines of evidence show that human influence on the Earth's climate is an established fact." [Daniel Murphy, United States of America]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily and states that "It is an established fact that human influence has warmed the climate and that widespread and rapid climate changes have occurred.". We believe it's more appropriate to enumerate the changes in the supporting bullets, rather than in the headline statement, to keep the latter short.

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42385	4	19	4	25	key message is in line 23-24. Consider editing so key message comes first. [Tina Christensen, Denmark]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
44955	4	19	4	25	This first red box is great! Why is this not in the introduction? I feel very strongly that this should be the first thing policy makers see. [Catherine Linsky, United States of America]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". Additionally, the rest of the former red box is now covered in the introduction of section 'current state of the climate'.
50077	4	19	4	25	The sentence "human influence on the climate system since the mid-20th century is now an established fact" is a very important finding and so needs to be communicated in the clearest way possible. It is currently quite a passive statement which quite obscures the meaning - the sentence in A1.6 saying "It is now an established fact... that human activity has altered the climate system since the mid-20th century." is a much clearer way of phrasing it, and makes the attribution much clearer. If it is possible to indicate the scale of this attribution e.g. saying that human activity is 'a major' or 'the dominant' cause of 'climate change', that would be helpful to include here too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"
50079	4	19	4	25	A sentence on human influence should be clear and prominent in the SPM - it might be best placed at the start of this headline statement. At the present it is buried among other pieces of information that are of less relevance in a headline statement (and would suggest that these other sentences are removed and placed in a supporting bullet instead). However, at the moment, this statement gives no sense of the scale of this influence or the impact, and also seems to imply that influence only since the mid-20th century is a fact - what happened before? Suggest a sentence is added to communicate scale and impact and this attribution statement is looked at again and revised. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate" and on the fact that 'and that widespread and rapid climate changes have occurred'
42165	4	19	4	25	A.1 Headline - good, clear statements. E.g. ...an established fact, and L22-25 [Tina Christensen, Denmark]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate"

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129717	4	19	4	25	[PROGRESS] The pink box summary for Section A.1 could more fully communicate that, based on research advances since publication of AR5, human-caused climate change is now an established fact, and has pushed some climate components, such as mean surface temperature, to historic levels. Since busy policymakers are most likely to read the pink-highlighted summaries and skim over the rest, summaries should communicate the essential conclusions of each section as fully as practical. Suggested revisions for the A.1 summary follow (additional language IN CAPITALS, suggested deletions in [brackets]): "Several centuries of climate science research have increased knowledge about how Earth's climate varies naturally and how it responds to human perturbations. [These] Advances SINCE AR5 are the result of more and higher quality observations, expanded information about past climates, improvements in theoretical understanding, and the development of more comprehensive climate models. Due to these multiple independent lines of evidence, human influence on the climate system since the mid-20th century is now an established fact, WITH SOME CLIMATE COMPONENTS NOW IN STATES UNPRECEDENTED IN THE HISTORY OF HUMAN CIVILIZATION." [Trigg Talley, United States of America]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate" and on the fact that 'and that widespread and rapid climate changes have occurred'. We believe that those are the key messages of the section and hope that the other information mentioned in the comment would be easier to find in the bullet points, given that the revised SPM is much shorter.
64749	4	19	4	25	The statement « human influence on the climate system since the mid-20th century is now an established fact » is relatively « weak » considering the stronger evidence on this topic since AR5 that is reported. There is indeed no reference to warming contrary to the statement of chapter 3 executive summary (page 4 l10) : «It is virtually certain that human influence has warmed the global climate system. » . There is no mention of a « dominant » human influence at least on GSAT. [Serge PLANTON, France]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
80623	4	19	4	25	I suggest starting the box with the current last line: "Human influence on the climate system since the mid-20th 24 century is now an established fact, buildin on multiple lines of evidence." This is what people will want to take home from the box; the rest are arguments building the case. [Bjorn Samset, Norway]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
97185	4	19	4	26	"several centuries"? Fig. TS.3 indicate that research started in the 18th century, this is at most "a few". We would prefer "about two centuries". [Nicole Wilke, Germany]	Not applicable, sentence removed.
34961	4	19	4	50	The SOD claims that many climate components are now in states not experienced for centuries to millennia. Please see general rebuttal comments #1 to #12 above. [Jim O'Brien, Ireland]	Noted. See HS2 for unprecedentedness in the climate system.
42001	4	19	43	32	The headline statemens (the texts in the red boxes) of each section should provide clear messages, focusing only on the key points of the section and should be formulated to inform a policy audience that are not experts in the field. The headline statements should also provide a "stand-alone", logical structure and story when combined together without the subsections. [Juhani Damski, Finland]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets.
101501	4	19			Change "increased knowledge about how Earth's climate" to "increased knowledge and understanding about how Earth's climate" [Knut Nadelhoffer, United States of America]	not applicable. Sentence no longer appears in revised version

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111089	4	19			I like the historical material in A.1.1. its interesting but wouldn't use it in the headline statement, so I would move the very first sentence down [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Taken into. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". Historical material is now briefly mentioned in the introduction of section 'current state of the climate'
107945	4	20	4	20	"These advances" would make more sense as "Recent advances" as this sentence is about changes since AR5 whereas previous sentence was about all of climate science history. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, sentence removed.
11577	4	20	4	22	This sentence ("These advances are the result of ...") seems to refer to the preceding sentence, which talk about centuries of research, but actually it does refer to much more recent progress: model improvement, better data, etc. (and the sentence that follows also clearly shows this). So it would be better to write "Recent advances are the result of..." [Gerhard Krinner, France]	Not applicable, sentence removed.
38875	4	20	4	23	Are the "lines of evidence" mentioned here the same as in Chapter 7.5? Chapter 7 seems to use this expression in a way that suggests it is an established technical term. But perhaps it is not? This could lead to confusion. (Please also check line 43 accordingly). [Maike Nicolai, Germany]	Taken into account. 'lines of evidence' no longer mentioned in the revised headline statement (HS1).
42167	4	20			A.1 headline: human perturbations - perturbations from human activities? Or simply human activities. [Tina Christensen, Denmark]	Not applicable. Sub-sections don't have headings anymore. Instead they are opened with much shorter and simpler headline statements
129719	4	21	4	23	"due to these multiple independent lines of evidence": Observations, information of past climates, improvements in theoretical understanding, and comprehensive climate models are not independent. Observations are used to inform and calibrate climate models, and theoretical understanding is used improve models, etc. Perhaps it's more fair to simply say multiple lines of evidence. [Trigg Talley, United States of America]	Taken into account. 'lines of evidence' no longer mentioned in the revised headline statement (HS1).
97187	4	21	4	24	Please add "including global warming" and add a confidence statement "virtually certain" so that the sentence reads "Due to these multiple independent lines of evidence, human influence on the climate system, including global warming, since the mid-20th century is now an established fact (virtually certain)." [Nicole Wilke, Germany]	Taken into account, we now state that human influence has warmed the climate system. Rejected. Uncertainty language is not needed for statements of fact, which is the case here (statement of fact is stronger than virtually certain).
45207	4	22	4	22	"more comprehensive climate models." can be replaced by "more comprehensive climate models and methodologies that allow objective assessment of both the natural and human-induced changes on the climate system " [Krishnan Raghavan, India]	Not applicable. Text removed from the revised headline statement HS1.
112139	4	22	4	24	This is a good, powerful statement to make up front. However, some may still dispute this, so how does IPCC actually distinguish between fact and surmise? That may be a philosophical question, but I'm not sure that the IPCC calibrated uncertainty language actually confronts this question (or does it?). Is it worth checking? [Timothy Carter, Finland]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". Uncertainty language is not needed for statements of fact, which is the case here (statement of fact is stronger than virtually certain).
86543	4	22	4	24	The text refers to Fig SPM1 and SPM2, but these two figures don't show that "human influence on the climate system since the mid-20th century is now an established fact". They show changes, not attribution to human activities. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised statement HS1 now refers to revised figures SPM1 and SPM2, which do show the human influence.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
24111	4	22	4	24	This seems a flawed conclusion, both in terms of the evidence that supports it and in terms of how it has been communicated. It seems strange to argue that human influence on the climate system is an established fact only since the mid-20th century. If there is a human influence on the climate system, then it was certainly already present before the mid-20th century. In AR5, the human influence on climate is clear statement was not qualified to being after a particular period and I don't see why AR6 is now arguing this way. AR5 also chose to protect the integrity of the attribution evidence on warming - at that time - extremely likely - whereas It seems like in AR6 there might be an attempt to fold in the attribution evidence based on analyses since the mid-20th century based on the statement at page 5, lines 17-24 - "it is now an established fact in AR6 that human activity has altered the climate system since the mid-20th century." But the evidence of human influence on the climate system as assessed in Chapter 3 does not support that. Rather human influence on warming of the climate system in the Chapter 3 ES is assessed as being "virtually certain" - not certain. Also the attribution statements in Chapter 3 are formulated since 1851-1900 (which can be regarded as being equivalent to pre-industrial) not since the mid-20th century and are still at the "extremely likely main" level. So I think that lines 23-24 on page 5 need to be deleted after "stronger" as well as the statement in the box at these lines. I don't know why the SPM doesn't stress the "extremely likely" attribution of temperature change since pre-industrial times. That it seems to me would be a very policy relevant statement in addition to being properly traceable to chapter 3. [Peter Stott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Reference to mid-20th century removed from HS1 and assessment of chapter 3 updated to 'unequivocal', as a result we can use a statement of fact in HS1 (as this is stronger than 'extremely likely').
87359	4	22	4	24	The wording 'established fact' in the sentence '...human influence on the climate system... is now an established fact' communicates well, however these wording is not used the underlying chapters. In ch 3 ExSum page 3-4 line 10 and 3.8.1, page 3-76 line 8, the qualifier 'virtually certain' in italics is used, consistent with the consolidated IPCC uncertainty language.. Moreover, 'established fact' and 'virtually certain' have slightly different meanings. An SPM must be based for 100% on the underlying chapters. Since the statements of the IPCC on human influence on climate are one of the most cited ones and are the basis of all climate change policy, utmost care needs to be taken in the wording. I suggest either adjust the text in chapter 3, or (better) adjust the statement here and use 'virtually certain'. [Marcel Berk, Netherlands]	Taken into account. Chapter 3 revised its assessment to 'unequivocal', which can be used interchangeably with 'established fact', as both denote statements of facts.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50089	4	22	4	24	This seems a flawed conclusion, both in terms of the evidence that supports it and in terms of how it has been communicated. It seems strange to argue that human influence on the climate system is an established fact only since the mid-20th century. If there is a human influence on the climate system, then it was certainly already present before the mid-20th century. In AR5, the human influence on climate is clear statement was not qualified to being after a particular period and it is not clear why AR6 is presenting it in this way. AR5 also chose to protect the integrity of the attribution evidence on warming - at that time - extremely likely - whereas It seems like in AR6 there might be an attempt to fold in the attribution evidence based on analyses since the mid-20th century based on the statement at page 5, lines 17-24 - "it is now an established fact in AR6 that human activity has altered the climate system since the mid-20th century." However the evidence of human influence on the climate system as assessed in Chapter 3 does not support that. Rather human influence on warming of the climate system in the Chapter 3 ES is assessed as being "virtually certain" - not certain. To address this suggest to delete the "since the mid-20th century", and also delete the sentence at page 5 lines 22-24 which is not supported by the chapter 3 assessment, and replace this with a statement that includes the sentence from the Chapter 3 ES about virtually certain. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. 'Since the mid 20th-centuy' is no longer mentioned. Note that the ES in chapter 3 now assesses the human influence on the climate system as 'unequivocal', which is also a statement fact.
12631	4	22	4	25	Audience did not see "mulriple independent lines of evidence" and what is "human influence" up to now. This should be put after SPM-B. [Lijing Cheng, China]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
80477	4	22	4	25	The wording 'established fact' in the sentence '...human influence on the climate system... is now an establised fact' communicates well, however these wording is not used the underlying chapters. In ch 3 ExSum page 3-4 line 10 and 3.8.1, pag 3-76 line 8, the qualifier 'virtually certain' in italics is used, consistent with the consolidated IPCC uncertainty language.. Moreover, 'established fact' and 'virtually certain' have slightly different meanings.. An SPM must be based for 100% on the underlying chapters. Since the statements of the IPCC on human influence on climate are one of the most cited ones and are the basis of all climate change policy , utmost care needs to be taken here in the wording. So either adjust / the text in chapter 3 or adjust the statement here and use 'virually certain'. [Leo Meyer, Netherlands]	Rejected. Uncertainty language is not needed for statements of fact, which is the case here (statement of fact is stronger than virtually certain). The term 'established fact' is supported in the TS and in the revised chapter 3, which talks about 'unequivocal' human influence on the climate system.
81407	4	22			copy lines 38-40 into the box at line 22 [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
81939	4	23	4	24	It would be very helpful if a statement can also be made about pre-1950 attribution as well. [Dan Zwartz, New Zealand]	Taken into account. Reference to mid 20th century removed from headline statement HS1

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54583	4	23	4	24	By adding a time period to the statement about human influence on the climate system ("since the mid-20th century"), this sentence now seems weaker than the factual statement in the WGI AR5 SPM ("Human influence on the climate system is clear"). The revised headline statement B2, in the Corrigendum to the SPM, is better, and also does not limit the statement about human influence on the climate system to a particular time period. The authors may wish to consider whether or not both headline statements A1 and B2 should include similar statements about human influence on the climate system. Overlap and potential inconsistencies in phrasing are a concern. [Nancy Hamzawi, Canada]	Taken into account. Reference to mid 20th century removed from headline statement HS1, which clarifies that 'It is an established fact that human influence has warmed the climate system'.
50081	4	23	4	24	This is a very important and policy-relevant key message (first section of section C preamble - 'climate models explore a subset of possible futures...') and it would be helpful if it could be made more prominent within the A1 chapeau. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
50083	4	23	4	24	This statement seems at odds with the findings in Chapter 7, p.7 L31 which states that "It is unequivocal that human activity has had a warming effect on the Earth since 1750." Could you amend or clarify, please? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". 'Unequivocal' and 'established fact' are both statements of facts and can therefore be used interchangeably .
65493	4	23	4	24	Suggest also including a statement about pre-1950 attribution. [Kushla Munro, Australia]	Taken into account. Reference to mid 20th century removed from headline statement HS1
38873	4	23	4	24	This reads as if it is a new information that humans influence the climate system. Hasn't this fact has been established before and expanded on in previous IPCC reports? I think this is the message of A1.6? So what exactly does "now" mean here? What is the new aspect? Otherwise I would borrow the expression from A1.6 here and underline the strengthening of the evidence. [Maike Nicolai, Germany]	Rejected. Headline statement HS1 is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate". In AR5 it was said that 'It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century', while here the evidence is presented as a statement of fact.
76781	4	23	4	24	Very good to see the clear language here, and advancement from previous reports to clearly state that human influence on the climate system is now an established fact. [Nerilie Abram, Australia]	Noted with thanks
3575	4	23	4	24	If the report describes as "established fact", confidence level should be "virtually certain" of "extremely likely" whereas there is no confidence level is shown. Please add the confidence level. [Mitsutsune Yamaguchi, Japan]	Rejected. No uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact. This is the case in here.
76877	4	23	4	25	This ends with the key statement on the human impact. Perhaps start with this. Also have human only impacted the climate system since mid 20th Century [Emer Griffin, Ireland]	Taken into account. Reference to mid 20th century removed from headline statement HS1, which is now much simpler, shorter and primarily focuses on the fact that "It is an established fact that human influence has warmed the climate".
19477	4	24	4	24	Since WG I WG6 is paying close attention to the issue of communication (color guidelines, etc.), I wonder if it's worth considering the implication of the word choice of "fact" in a post-truth, post-factual world. Unfortunately I cannot come up with a good alternative to "fact." [Masahiro Sugiyama, Japan]	Noted but fact remains the word to refer to a statement of fact.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112181	4	24	4	24	"now an established fact" is an awkward phrase. Before this Assessment, a lot of elements were already well discerned, now these have grown stronger. I think it is a stretch to give the impression that AR6 is the "now" when human influence has started to get established. [venkatachalam ramaswamy, United States of America]	Taken into account. 'now' removed from HS1. Note however that it's the first time that an IPCC report concludes that the evidence of the human influence on the climate is so overwhelming it can be considered as a statement of fact.
69965	4	24	4	24	I think Figures SPM.1 and SPM.2 give us very similar story. To make SPM efficiently, I would like to suggest only one of these figures should be used. [Young-Hwa BYUN, Republic of Korea]	Accepted. Figure SPM.2 has been removed from the revised SPM.
65403	4	24	4	24	The section describes the human influence as "an established fact". For the warming, that is described as "unequivocal". Why not say that human influence is unequivocal and use the same terminology. Or change the description of warming to be an established fact. These mean the same things, so they should use consistent terminology. [Andrew Dessler, United States of America]	Taken into account. In the revised SPM, both statement have been combined in HS1 and we are only talking about 'established fact'.
29383	4	24	4	24	the reference period for the numbers given in Fig SPM2 has to be named in the caption [Joachim Fallmann, Germany]	Not applicable, figure removed from revised SPM.
53451	4	24			"Established fact" could be the focus of long discussions during the approval session. What about "well-established scientific fact" to avoid unnecessary philosophical arguments? [Hervé Douville, France]	Rejected. We prefer to the current phrasing, which is simpler, shorter and more straightforward, especially given that the suggestion would not necessarily prevent the philosophical arguments.
81733	4	27	4	27	Key features, but also the changes - would be good to mention that the major functioning of the observed changes are well understood. That is also what is stated later in this paragraph (e.g. anthropogenic drivers, greenhouse gases...) [Karina von Schuckmann, France]	Not applicable. Bullet point removed from revised SPM.
4537	4	27	4	27	Authors claim that "Understanding of key features of the climate system is robust and well established." This is an exaggeration. There are still huge uncertainties of many components of the climate system. We are just beginning to understand natural variability. Climate models consistently overestimate warming. SO2 aerosols cool much less than previously thought, implying that some of the excess warming that had been interpreted cannot be cooled down by aerosols. CO2 climate sensitivity is only poorly known and the wide range has not changed for the past 30 years. How can on then say the understanding of the climate system is robust and well established? There are quite a few papers involving prominent IPCC authors who warn to overstate the case. They recommend to openly communicating the remaining uncertainties. Authors of AR6 SOD Chapter 1 are apparently ignoring these recommendations. It is true that the main drivers of climate are now qualitatively known quite well. However, in a quantitative sense, we are still far away from putting this puzzle together. I strongly suggest avoiding misrepresenting the current scientific understanding in the executive summary of Chapter 1. This harms the credibility and may ultimately undermine climate protection initiatives once the exaggeration is published and subsequently identified and criticized in public. [Sebastian Luening, Switzerland]	Not applicable. Bullet point removed from revised SPM.
129721	4	27	4	28	Strike "with the circulation of the atmosphere...since the 17th century" to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Not applicable. Bullet point removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
109289	4	27	4	31	Should be 17th century, 19th century, 20th century. No hyphens needed because these phrases are not serving as adjectives modifying other phrases (as in "17th-century observers"); instead, 17th (etc.) are adjectives modifying "century." "Mid-1970s" can stay, but some style guides suggest "mid 1970s" would be better (since "mid" modifies "1970s.") [Paul Edwards, United States of America]	Not applicable. Bullet point removed from revised SPM.
86545	4	27	4	32	Is this paragraph really needed ? IPCC is supposed to assess the new science (in particular since AR5), not to write an history of climate science. Wikipedia does that very well (https://en.wikipedia.org/wiki/History_of_climate_change_science) ! [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Bullet point removed from revised SPM.
76881	4	27	4	32	It would be useful to start with how the stability of the climate system is determined by the energy balance and then go through the factors which can change this balance both natural and human driven. [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
76883	4	27	4	32	For clarity end first sentence at established. Shorten the then 2nd sentence. Surely some of the natural drivers were studied earlier? E.g. solar activity. Split sentence after 20th Century. [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
76885	4	27	4	32	Heat absorbing gases may be confusing. These gases regulate the energy balance not just absorb heat referring to a vapour as a gas could be confusing. [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
76887	4	27	4	32	Mixing changes which are linked to solar variability and planetary motion with those linked to changes in atmospheric composition should be avoided. These are natural but very different. [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
87153	4	27	4	32	Since we have explicitly been challenged to give attention to ways of shortening the SPM, we believe that the level of detail in this para (A1.1) could be reduced. We understand the rationale for having it included, but think it does not bring in new information. [Oyvind Christophersen, Norway]	Taken into account. Bullet point removed from revised SPM.
8591	4	27	4	32	great to have this multi-century perspective of climate science [Jonathan Lynn, Switzerland]	Noted with thanks
5265	4	27	4	32	If a busy policymaker reads only one conclusion from this section, which one do you want it to be? That the circulation of the atmosphere was studied in the 17th century, or that observations provide unequivocal evidence of a changing climate? Put the most important conclusion first! Move A.1.1 down, perhaps after what is now A.1.3. Or better, delete it for brevity [Daniel Murphy, United States of America]	Accepted. Bullet point removed from revised SPM.
129723	4	27	4	32	[PROGRESS] A1.1 summarizes knowledge prior to 21st century, not new findings since AR5 or special reports. Such a recap is not needed and can be deleted to save space. [Trigg Talley, United States of America]	Accepted. Bullet point removed from revised SPM.
87241	4	27	4	32	The exchange of global meteorological data started in 1873 (International Meteorological Committee, the precursor of WMO). That made it possible to study the circulation of the atmosphere (although some features of surface winds were known much earlier due to shipping routes). The role of water vapor and CO2 as greenhouse gases were known at the end of the 19th century, but that is not the case for methane. We strongly recommend to skip this section A1.1. [Marcel Berk, Netherlands]	Accepted. Bullet point removed from revised SPM.
81735	4	27	4	41	there is almost no uncertainty statement [Karina von Schuckmann, France]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42387	4	27	4	41	consider swapping A1.1 and A1.2 [Tina Christensen, Denmark]	Not applicable. Bullet point removed from revised SPM.
103989	4	27	5	24	Re-order the statements in the section from most to least important. E.g. A1.6, that climate change is an established fact, is the key statement. The others (about observations, better models etc.) are the evidence that supports this statement. [Philippe Tulkens, Belgium]	Accepted. The headline statement opening the revised SPM is now about the fact human influence on the climate is an established fact.
15421	4	28	4	28	It is strongly suggested not to include water vapour here in this context because water vapour is a feedback agent instead of a forcing to climate change (Ref.: AR5 WGI FAQ 8.1). The role of water vapour has long been deliberately misinterpreted by climate change deniers to mislead the general public. The current text in the SPM will only help to perpetuate the climate myth of "water vapour is more important than carbon dioxide". Ref.: https://news.utexas.edu/2010/11/09/century-old-climate-myth-still-making-the-rounds/ ; https://www.newscientist.com/article/dn11652-climate-myths-carbon-dioxide-isnt-the-most-important-greenhouse-gas/ . Please consider revision. [SAI MING LEE, China]	Not applicable. Bullet point removed from revised SPM.
89649	4	29	4	29	the use of the term "heat-absorbing gases" is probably meant to be helpful for readers, but since the term "greenhouse gases" is used everywhere else in the SPM it is probably more confusing than anything else. [Trude Storelvmo, Norway]	Not applicable. Bullet point removed from revised SPM.
37205	4	29	4	29	It is false to claim that atmospheric methane is a major heat absorbing gas. (Repeating a fallacy doesn't make it correct.) In isolation methane absorbs and scatters heat but in the atmosphere the absorption wavelengths of methane overlap with that of water and methane is a mere 1.6ppmv but water vapour on average is around 15,000 ppmv. Methane plays a negligible role in the atmosphere absorbing infrared energy. [John McLean, Australia]	Not applicable. Bullet point removed from revised SPM.
65487	4	29	4	29	Suggest changing this to "infrared heat-absorbing gases" or "infrared energy-absorbing gases" to distinguish from other forms of heat e.g. latent or sensible. [Kushla Munro, Australia]	Not applicable. Bullet point removed from revised SPM.
38877	4	29	4	29	"heat-absorbing" might be technically correct, but people outside the scientific community might associate "absorbing" with "sucking up" in the sense of "make disappear". Would "heat-trapping" be an option here? [Maike Nicolai, Germany]	Not applicable. Bullet point removed from revised SPM.
69289	4	29	4	30	It would be better to modify "the principal drivers of natural climate variability (orbital changes, the solar cycle and volcanic activity)" to "external natural factors such as orbital changes, the solar cycle and volcanic activity" as contained in Box SPM.1, because "natural climate variability" such as El Nino Southern Oscillation is generally driven by internal dynamics of the atmosphere-ocean coupled system, not by the external forcing as listed above. [Kaoru Magsaki, Japan]	Not applicable. Bullet point removed from revised SPM.
101503	4	29			Change "carbon dioxide and methane" to "carbon dioxide, and methane" [Knut Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37207	4	30	4	30	The various oceanic oscillations (e.g. ENSO, NAO) have been shown multiple times to impact climate. As stated above (for page 3 lines 26-30) these oscillations most likely get their heat from the sun, which is external to Earth's climate system, ergo they are not merely internal variability. These also influence the temperature records to the extent that they influence the trends in data across periods that can be as long as at least 50 years. [John McLean, Australia]	Not applicable. Bullet point removed from revised SPM.
44693	4	30	4	30	It would be useful to say something about time scales as the examples operate on rather different timescales, not all relevant for the timescales of anthropogenic forcing. [Markku Rummukainen , Sweden]	Not applicable. Bullet point removed from revised SPM.
90887	4	31	4	32	In the phrase "and other major human-related drivers, such as aerosols and land-use change, were described by the mid-1970. It should read "since" that may help you clarify that even though those phenomena have been described in 1970, there have been improvements ever since. [Alvaro Zopatti, Argentina]	Not applicable. Bullet point removed from revised SPM.
76889	4	31	4	32	Were described by the 1970's is not clear. It is arguable that aerosol impacts were described earlier with major uncertainties [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
76891	4	31	4	32	This text could be replaced with a shorter simpler statement based on the 1st line + research over many centuries which continues today [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
76893	4	31	4	32	The term aerosol is well known in atmospheric science but is used more broadly elsewhere, perhaps use PM here. [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM.
54439	4	31	4	32	and other major human-related drivers, such as aerosols and land-use change, were described by the mid-1970. It should read "have been described since 1970". [Maria del Pilar Bueno Rubial, Argentina]	Not applicable. Bullet point removed from revised SPM.
44695	4	32	4	32	Suggest "first described" or suchlike. [Markku Rummukainen , Sweden]	Not applicable. Bullet point removed from revised SPM.
129725	4	32	4	32	What about stratospheric ozone depleting substances? [Trigg Talley, United States of America]	Not applicable. Bullet point removed from revised SPM.
86897	4	33	4	33	One observation is that the SPM text moves very quickly to evidence of a changing climate in paragraph A.1.2. It could be considered to add a new paragraph prior to A.1.2, describing natural variability as it would be expected "without" human perturbation. The presentation in the introductory part of the SPM could benefit from such a paragraph, indicating for readers a helpful "baseline" of what would be expected from a climate still dominated by a state of natural variation. [Oyvind Christophersen, Norway]	Not applicable. Bullet point removed from revised SPM to shorten the SPM and focus on what matters most. Note however that the influence of natural variability on global temperature is shown in Fig SPM.1b.
86061	4	34	4	34	Given what AR6 is aiming to achieve, it is advisable to use the strongest possible language that it still scientifically correct. "unequivocal" is a strong word, but does not communicate the point as clearly as for example conclusive, definitive, absolute, unquestionable, indisputable, irrefutable, unambiguous, unqualified. What is the best word for non-academics or people for whom English is not their first language? "cannot be explained without human induced warming" as in B.4.2 is also a very powerful yet simple way to say it. [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted. Text changed in FGD to established fact
103991	4	34	4	34	The time period of mentioned observations should be indicated. [Philippe Tulkens, Belgium]	See 111623

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112183	4	34	4	34	"changing climate" - too weak! The evidence, strong as it is from observations, models, analyses, is one of a warming and not just a 'changing' world (as exemplified in fact by the later portions of this very para.). Changes in the climate system are mostly reflecting the effects of a warming continuing to be underway. Almost all indicators are pointing in that direction, very few if any negating that impression unambiguously. [venkatachalam ramaswamy, United States of America]	Taken into account. Redrafting has led to stronger phraseology
82527	4	34	4	34	Is a qualifier needed here to reflect the fact that warming does not occur at all levels of the atmosphere? I don't think so in this context but floating the issue just in case it hadn't been thought about. [Blair Trewin, Australia]	Taken into account. A simpler formulation without the room for such ambiguity has been employed
87155	4	34	4	34	Please consider to find a better word than "unequivocal". It might be due to not having english as our mothertongue, but there must be better alternatives that are easier to understand. Word like "clear" or, less preferably, "undisputable" are alternatives that you could consider to help readers undertstand you message. [Oyvind Christophersen, Norway]	See 86061
65019	4	34	4	34	"changing climate" is too weak and vague, climate always changes somehow. Why not the Chapter 2 formulation "evidence of a warming world" (this is much more specific, and also clear in the sense that a changes are all consistent [Johannes Quaas, Germany]	Taken into account. Redrafted substantively to be stronger in FGD
78927	4	34	4	36	include the rates of change which are perhaps what is most unusual about this period [Pedro Monteiro, South Africa]	Taken into account. Between HS1 and HS2 in the redraft this has now been made much clearer.
111623	4	34	4	37	This sentence needs to specify a time period. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There is no single simple time period because period of the observational record and availability of and duration of paleo records differs by variable.
86547	4	34	4	37	Not critical, but I would suggest listing the greenhouse gas concentrations first and then all the changes in the cliumate system. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. In redrafted HS1 and HS2 the GHGs now precede the responses
27683	4	34	4	37	Please specify the period compared to which the climate is changing. [Eric Brun, France]	See 111623
15423	4	34	4	37	It is suggested to put "greenhouse gas concentrations in the atmosphere have increased" at the beginning rather than the end of the long list of oberved physical changes because the increase in greenhouse gas concentrations is the primary driver of other changes in the list. [SAI MING LEE, China]	See 86547
131663	4	34	4	37	Over what time period? [Hans Poertner and WGII TSU, Germany]	See 111623
76895	4	34	4	37	Ocean pH is determined by chemistry not climate. Best not use here. [Emer Griffin, Ireland]	Accepted. Ocean pH now included in a more logical manner
76897	4	34	4	37	The increase in GHG level is a driver of climate change not a feature of a changing climate [Emer Griffin, Ireland]	See 86547
42171	4	34	4	38	A1.2: Important and clear message. Keep L34-38 [Tina Christensen, Denmark]	Noted. All relevant aspects have been retained
37209	4	34	4	41	Be honest. Most of this paragraph is based on estimates because there was no widespread measurement of these factors until releatively recently. [John McLean, Australia]	Rejected. The assessment text is based upon the underlying assessment across chapter 2 and a range of additional chapters which is firmly grounded in the literature.
76901	4	34	4	41	This paragraph could be clearer and perhaps broken up into key sections as many of the statements are open and unclear [Emer Griffin, Ireland]	Accepted. Redraft of HS1 does this

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50085	4	34	4	41	The phrase 'Observations provide unequivocal evidence of a changing climate' could be misinterpreted to imply that observations could provide evidence, rather than they do. This could be rephrased for clarity, for example, "The climate is changing, as unequivocally demonstrated by observations such as..." [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Redrafted for clarity.
50091	4	34	4	41	The statements in A1.2 are highly policy relevant- suggest that these are elevated to the A1 headline statement to replace the information currently there. In reference to lines 39-41, it would be helpful to make it clear that this variability is outside natural variability, and specify how 'likely' this is due to human influence. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. These comments have largely been addressed in redrafting to HS1. The messages and narrative have been strengthened accordingly.
129727	4	34	4	41	[PROGRESS] A2.1 does not report any new findings on climate since AR4 or AR5, so can be deleted. [Trigg Talley, United States of America]	Rejected. There has been key progress since AR5 which this attempts to summarise
64781	4	34	4	50	Recommend inclusion of language to note reductions in Arctic and mountain permafrost, and spring snow coverage as additional, and separate, indicators from glacial and ice sheet melt. [Casey Kopcho, United States of America]	Taken into account. Projections in permafrost and snow cover are covered in HS.11 and in Figure SPM.9.
81209	4	34	4	50	Several changes are gathered in subsection A.1.2 including ocean warming and SLR, however A.2.3 is entirely dedicated to observed changes in ocean. This create some unjustified unbalance. [Fatima Driouech, Morocco]	Not applicable. SOD-section A no longer exists in the revised SPM but the important information it contained has been integrated in the new section on the current state of the climate.
27685	4	35	4	35	The distinction between ice and glacier is not very clear. What does "ice" refer to ? Sea-ice ? Ice sheets ? [Eric Brun, France]	Taken into account. Clarified in edits to HS.1
27687	4	35	4	35	We suggest to change "sea levels" into "global sea level" except if the plural convey a wider message which should then be clarified. [Eric Brun, France]	Accepted. Changed in HS1.7
39521	4	35	4	35	There is no clear evidence that the largest glacier of the world, Antarctica, experienced mass loss within uncertainties. In addition, the sea ice around it showed an increase of 11,300 km2 per year (www.pnas.org/cgi/doi/10.1073/pnas.1906556116) [François Gervais, France]	Rejected. Antarctica is an ice sheet not a glacier and is assessed accordingly. Additionally, the paper mentioned actually reports a decrease of Antarctic sea ice after 2014, this is consistent with our assessment that 'Antarctic sea-ice area has experienced no significant overall change since 1979'.
88443	4	35	4	35	are you referring to sea ice or ice sheets here (statement only indicates ice) [Sharon Smith, Canada]	Taken into account. Ambiguity resolved in edits to HS.1
15367	4	35	4	36	There are not so many clear evidences of changes of pattern of extreme weather. Among them, section 11.7 should be referred to as related to A.1.2 as examples of patterns of extreme weather have changed (tropical cyclones). [Masaki Satoh, Japan]	Rejected. The structure of the SPM is such that extremes are handled elsewhere from the large-scale mean changes. This is felt to aid rather than hinder readability and reader comprehension
38879	4	36	4	36	Suggestion to say "the ocean has become more acidic" instead of "ocean pH has declined", because the pH scale and concept behind it might not be clear enough for all your readers. [Maike Nicolai, Germany]	See 66921
29195	4	36	4	37	The item "greenhouse gas concentrations in the atmosphere have increased" should be given independent of other items to another sentence. [Hiroshi Kanzawa, Japan]	Accepted, done
66921	4	36			"ocean acidity has increased" seems more accessible and clear than "ocean PH has declined" [Mathew Barlow, United States of America]	Accepted, revised text alludes to acidification in HS.1 and HS.2
27689	4	37	4	37	The biosphere has responded not only to to global warming but also to increase CO2 concentrations so far, and maybe more from the latter than the former. [Eric Brun, France]	Taken into account. Revised bullet concentrates on the more unambiguously climate related component changes
9599	4	37	4	37	The biosphere has responded not only to to global warming but also to increase CO2 concentrations so far, and maybe more from the latter than the former. [Olivier Boucher, France]	See 27689

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86549	4	37	4	38	"Evidence of tyhe biosphere response ..." Unclear and weak statement. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Biospheric component made more explicit in HS1.8
50087	4	38	4	38	It is not clear here what is meant by the term 'climate components'. Please could this be clarified or defined, do you mean components of the climate system, or climate variables? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See 103993
117195	4	38	4	38	Only physical indicators? What about chemical indicators? [Maisa Rojas, Chile]	See 103993
27691	4	38	4	40	We suggest to distinguish the two sentences, since this is the only textual appearance of the unprecedented rate of climate change (except for graphs) while it is a crucial scientific fact. Would thus read : "Many climate components are now in states not experienced for centuries to millennia or longer. Since 1900 several key indicators of the global climate system have changed at a rate unprecedented over at least the last two thousand years." [Eric Brun, France]	Taken into account. The text, which now constitutes the HS2 headline has been reformulated for. clarity
103993	4	38	4	41	Examples of "many climate components" should be indicated. [Philippe Tulkens, Belgium]	Taken into account. Text removed.
76899	4	38	4	41	This lacks clarity, e.g., many components? Several key indicators? [Emer Griffin, Ireland]	See 103993
74009	4	39	4	40	Would be nice to list a few of the key indicators not just send the reader to figures [Sergiu Dov ROSEN, Israel]	See 103993
12633	4	39	4	41	To be more specific? [Lijing Cheng, China]	See 103993
86551	4	41	4	41	Fig SPM2 doesn't show anything about rate of change being unprecedented [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, Fig SPM.2 no longer exists in the revised version.
25721	4	43	2	43	This line only mentions AR5 and SROCC but does not mention SR1.5 and SRCCL, they should also be mentioned. [Don Alfonso Pino Maeso, Spain]	Noted. Any mention to Special Reports, including SROCC, was removed. All three Special Reports are introduced in Introduction section of the SPM.
17575	4	43	4	47	There is no solid evidence for an acceleration in sea level rise. Combining raw data from 6 different satellites over a short measuring time (involving many structural and ad-hoc corrections) with tide gauges, as some authors do, is apples with oranges while neglecting the large error margins. Sentence should be modified to also reflect the evidence for no acceleration in sea level rise based on tide gauge measurments. Especially because tide gauge measurements are most relevant for local coastal planning. It is a clear example of tunnel vision and AGW-selection bias in making the summary for policymakers. See also my comments related to AGW-groupthink, tunnel vision and selection bias for the entire report. [ferdinand meeus, Belgium]	Noted. The text does not discuss an acceleration in sea level rise. It simply states that measurements of total sea level change agree with the sum individual contributions for the period 1971-2018, within the estimated uncertainties.
40463	4	43	4	48	It is surprising that SRCCL is not mentioned in the SPM in regard to scientific findings. Maybe it could be mentioned in passing here, even if it is later, in A1.3 in relation to changes on land. [TSU WGI, France]	Noted. Any mention to Special Reports, including SRCCL, was removed. All three Special Reports are introduced in Introduction section of the SPM.
41063	4	43	4	48	There were a couple "gaps" that stood out -- here is one It is surprising that SRCCL is not mentioned in the SPM in regard to scientific findings. Maybe it could be mentioned in passing here, even if it is later, in A1.3 in relation to changes on land. Also true on page 8 line 7. Also a call out to the Atlas URL on page 4 might be helpful to the reader. [TSU WGI, France]	Noted. Any mention to Special Reports, including SROCC, was removed. All three Special Reports are introduced in Introduction section of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
103995	4	43	4	50	A1.3 - this statement, and the way it is written, is too technical for the SPM. The headline that energy budget is consistent with forcing estimates is too specialist for a non-expert reader. Suggest combining with statement A1.4 and making a more general point (certain climate change phenomena, and their causes, have been observed and are in line with ex ante projections. [Philippe Tulkens, Belgium]	Accepted. Text has been reorganised and considerably simplified
78929	4	43	4	50	include carbon - heat nexus - TCRE [Pedro Monteiro, South Africa]	Taken into account. TCRE discussed in HS13
76903	4	43	4	50	The opening sentence mentions fundamental aspects of climate change, the energy budget (is this the clearest term to use) and sea-level rise. These are important but vastly different. Perhaps separate these out as key elements of the report. Starting in this section. [Emer Griffin, Ireland]	Taken into account. SPM was reorganized with the distribution of the excess energy across the climate system covered in HS4.2 and the sea level budget covered in HS4.3
5267	4	43	4	50	This section is a good example of what I recommend for trying whenever possible to work the confidence into the text instead of setting it off in parentheses. It is more readable this way. [Daniel Murphy, United States of America]	Noted. Thanks
129729	4	43	4	50	[CONFIDENCE] Can the authors please review the "very likely" statement when referencing Cross-Chapter 9.2? The assignment of confidence does not track into that cross-chapter section. [Trigg Talley, United States of America]	Taken into account. The high confidence statement traces back to section 9.6.1.2, which is pointed to from Cross-Chapter Box 9.1 (the updated version of Cross-chapter box 9.2).
103997	4	43	4	51	Is this paragraph focused on the appearance of new evidence in general, or is it specifically about oceans and cryosphere? Why is SROCC singled out (why not SR1.5 and SRCCL too?). If the improvement in ocean-cryosphere evidence is particularly acute in ocean-cryosphere-related areas, the SPM should say so more directly. [Philippe Tulkens, Belgium]	Noted. Any mention to Special Reports, including SROCC, was removed. All three Special Reports are introduced in Introduction section of the SPM. FGD sections HS.1 and HS.2 refer to cryosphere.
130433	4	44	4	44	Global sea level should be "global mean sea level". [Panmao Zhai, China]	Noted. The final SPM uses global mean sea level.
103999	4	44	4	45	Replace "of Earth's climate system" with "of the Earth system". It is not trivial that GSL as such should be considered part of the "climate system". [Philippe Tulkens, Belgium]	Noted but the sentence has been removed in the revised version.
74011	4	44	4	47	There is a problem in my view with the 2019 limit, as strong changes have been published in 2020 in regards to ice caps melting, which apparently have not been encountered for in this draft report. [Sergiu Dov ROSEN, Israel]	Taken into account. The revised headline statement includes information on ice sheet mass loss that includes the recently observed increases using the updated IMBIE datasets.
27693	4	45	4	45	We suggest adding an explanation of this central concept, possibly in the introductory Box SPM.1, otherwise in a footnote. [Eric Brun, France]	Noted. This concept is defined in the AR6 WGI glossary and Box SPM.1 has been removed.
42339	4	45	4	45	Earth Energy budget: might be helpful to explain overall concept. [Tina Christensen, Denmark]	Noted. This concept is defined in the AR6 WGI glossary and the text has been rephrased to avoid mentioning 'energy budget'.
76905	4	45	4	45	Introduction to the energy budget (balance) earlier, as changes to this is the driver of climate change. Also a brief explanation is needed if a technical term such as energy budget is to be used here. [Emer Griffin, Ireland]	Noted. This concept is defined in the AR6 WGI glossary and the text has been rephrased to avoid mentioning 'energy budget'.
76907	4	45	4	45	Split this in two, with SLR being addressed in a separate para. Headline the energy budget and then where it goes . [Emer Griffin, Ireland]	Taken into account. SPM was reorganized with the distribution of the excess energy across the climate system covered in HS4.2 and the sea level budget covered in HS4.3
25725	4	45	4	45	The concept "Earth energy budget" should be explained [Don Alfonso Pino Maeso, Spain]	Noted. This concept is defined in the AR6 WGI glossary and the text has been rephrased to avoid mentioning 'energy budget'.
9601	4	45	4	45	It's the *combination* of the individual contributions that agree with the observed GSL rise, not the individual contributions as these cannot be separated in the observations of the GSL rise. [Olivier Boucher, France]	Taken into account. Text has been revised/clarified.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
10179	4	45	4	47	"global sea level" -> "global mean sea level" [Robert Kopp, United States of America]	Noted. The final SPM uses global mean sea level.
38881	4	45	4	47	This sentence basically says that observations agree with observations. This sounds like a circular argument to me. In addition, the details given in brackets are important and should be integrated in the sentence. Can this be rephrased for example like "Melting glaciers and ice sheets in Antarctica and Greenland, ocean warming, changing storage of water on land have been observed to contribute to the global sea level rise..." [Maike Nicolai, Germany]	Noted but the sentence has been removed in the revised version.
42173	4	45	4	49	A1.3: Important and clear message. Keep L45-49 [Tina Christensen, Denmark]	Noted. Thanks
25723	4	46	4	46	The concept "changing storage" should be explained. [Don Alfonso Pino Maeso, Spain]	Noted but the sentence has been removed in the revised version.
42389	4	46	4	46	should probably read: "melting glaciers and ice sheets in the Arctic and Antarctica" [Tina Christensen, Denmark]	Noted but the sentence has been removed in the revised version.
86063	4	47	4	49	Can "very likely agree with" and "very likely consistent with" be translated into something that is easier to understand? What exactly is very likely in these two cases? This is not clear. Is it referring to 90-100% agreement and consistency? [Debra Roberts and the Durban WGII TSU, South Africa]	Noted but the sentence has been removed in the revised version.
27695	4	48	4	48	The term "Earth's energy" is rather vague and unclear. Perhaps energy added to the Earth system? Change in energy balance? [Eric Brun, France]	Noted but the sentence has been removed in the revised version.
27697	4	48	4	48	The ocean warming is about 90% of the Earth's energy (and not "more than") - depending on study period, it can range around the 90% value. [Eric Brun, France]	Accepted. This was rephrased in section SPM section HS4.2
27699	4	48	4	48	Shouldn't read "ocean warming". Ocean warming is a consequence - not correct in this context - should be 'ocean heat storage' or equivalent. [Eric Brun, France]	Accepted. This was rephrased in section SPM section HS4.2
81737	4	48	4	48	more than 90%: would need to be changed to 'about 90%' - depending on study period it can range around the 90% value [Karina von Schuckmann, France]	Accepted. This was rephrased in section SPM section HS4.2
81739	4	48	4	48	ocean warming is a consequence - not correct in this context - should be 'ocean heat storage' or equivalent. [Karina von Schuckmann, France]	Accepted. This was rephrased in section SPM section HS4.2
65489	4	48	4	48	Suggest clarifying the statement "Observed increases in energy in the climate system (more than 90% accounted for by ocean heat increase) ..." [Kushla Munro, Australia]	Noted but the sentence has been removed in the revised version.
81495	4	48	4	49	The message conveyed in the sentence is unclear due to a combination of a few points. Recommend to break into 2 sentences. [Ee Ling Lee, Malaysia]	Taken into account. The SPM was reorganised to clarify the message. Additionally, the revised SPM no longer mentions effective radiative forcing.
4539	4	48	4	49	The 100% anthropogenic attribution does not reflect current scientific understanding. Significant natural warming rebound after the Little Ice Age is to be expected. Warming through CO2 during the early 20th century is limited. We are attributing a significant part of the warming 1980-2000 to multidecadal natural variability (PDO, AMO) which is neglected here. Climate models consistently overestimate warming. Where does the overconfidence of IPCC authors come from? Considering that the CMIP-6 models have mostly failed, it would now be the right moment to backtrack from the 100% anthropogenic claim and return to a more realistic mix of anthropogenic vs. natural climate drivers. Credibility of the IPCC is seriously at risk if these issues are not addressed in a more balanced way. [Sebastian Luening, Switzerland]	Taken into account. The Chapters are clear that a range of factors both natural and anthropogenic - but natural factors average to zero
29385	4	48	4	49	use a more detailed definition of 'earth energy' such as 'internal energy' or 'energy surplus' [Joachim Fallmann, Germany]	Noted. The term "Earth energy" was removed from the SPM

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54585	4	48	4	50	This text will be unclear to Policy-makers. The message could be clearer if formulated as for the global sea level results (i.e. that the observed estimate of SLR agrees with the estimates of contributions of components to SLR). Here, it would help to write that the observed increases in Earth's energy budget agree with estimates of effective RF from all major forcing agents (ADD "from all major forcing agents" after "effective RF"). Also, since effective RF is not in the core concepts, this might benefit from a footnote to make clear that RF is a measure of changes to the Earth's energy budget. [Nancy Hamzawi, Canada]	Taken into account. The terms sea level budget, energy budgets and effective radiative forcing are no longer mentioned in the revised SPM. Instead, HS4.3 talks about 'a consistent picture of the processes of global sea level rise'
90725	4	49	4	49	The use of the adjective "effective" in the expression "effective radiative forcing" is problematic. Indeed, in the Glossary, the definition of "effective radiative forcing" refers to that of "radiative forcing" and, again in the Glossary, "effective radiative forcing" is used only in relation to the radiative forcing of aerosols and clouds. [José Romero, Switzerland]	Taken into account. The term "Effective Radiative Forcing" was removed in the revised SPM.
129731	4	49	4	49	Revised estimates of effective radiative forcing and Earth's radiative response should be provided. [Trigg Talley, United States of America]	Taken into account. The term "Effective Radiative Forcing" was removed in the revised SPM.
84691	4	49	4	49	"revised estimates" what do it refer to? [Annalisa Cherchi, Italy]	Noted. The term "revised estimates" was removed in the revised SPM.
17435	4	49			effective radiative forcing' is explained on page SPM-8 but is first used here. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The term "Effective Radiative Forcing" was removed in the revised SPM.
41223	4	57	4	57	"established fact". Elsewhere in the SPM, "unequivocal" is used - are these two subtly different in intent? I personally prefer "unequivocal" [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Noted. No, both can be used interchangeably, as they are statements of facts. Note that in the revised SPM, established fact is only used in HS1 (unequivocal no longer features in the text).
116073	4		4		Problem in logical flow of information, the change in RF needs to be reported explicitly as a key aspect of understanding the Earth's energy imbalance driving human induced climate change. This aspect is too implicit here. [Valerie Masson-Delmotte, France]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
114921	4		7		Is it viable to have Part A as separate introductory part to the SPM? I very much like the intent of A.1 to provide an overview on how the knowledge on anthropogenic climate change has consolidated over the past years. At a few places I would have wished for a few numbers to demonstrate the consolidation quantitatively, but A.1 works as a section. However, I could also see it as an introductory section to Part B. A.2 is specific to emergence and scales and might be best combined with a section in Part B / Figure SPM.5 where present day regional climate change is presented. Finally, I was not sure what to make of A.3. If the idea is to introduce climate services, better to give concrete examples in Part D. [Elmar Kriegler, Germany]	Taken into account. In the revised SPM section has been removed with the most relevant information integrated in what used to be section B and is now the section on 'current state of the climate'

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114923	4		7		Part A is using GMST instead of GSAT. Since GSAT is the principal surface temp metric in the report according to Box SPM-1, I suggest to switch consistently to GSAT. [Elmar Kriegler, Germany]	Not applicable. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM."
8589	4		38		The introductory boxes for each section (in italics and green background) are very helpful but the term "preamble" doesn't sound right - it sounds too legalistic. Maybe just "Introduction"? [Jonathan Lynn, Switzerland]	Accepted. The word 'preamble' no longer features in the revised version.
107965	4				maybe "Earth's heat energy" is more accurate than "Earth's energy" [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, text clarified
90727	5	1	5	1	Write: "The patterns and accuracy of early climate change projections ...", since modelling aims, inter alia, at a broad understanding, quantification, visualization, visualisation and simulation of physical and biogeochemical processes. [José Romero, Switzerland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
112185	5	1	5	4	One problem in drawing upon the projections made in the 1990s is that they ignored or did not consider the full effects of aerosols as we know about these species over the past decade or so. Thus, while there may be fair agreement with the warming trend today as projected by models in the 1980s and 1990s, these are not necessarily telling the complete story of how the real-world trend may have been partly offset by aerosols till about the early part of this century, with this coupled with the reduced effects of aerosols over the past few years to decade. Lest there be any confusion, this 'close agreement' does not necessarily map onto other climate variables. [venkatachalam ramaswamy, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76909	5	1	5	4	Not clear on the values of this? What is the message? It is at best unclear our models were right but our scenarios were not? Perhaps delete. [Emer Griffin, Ireland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76911	5	1	5	4	Not clear on statements and their value here, e.g., out models were right but our scenarios were not? [Emer Griffin, Ireland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76913	5	1	5	4	Projections from the 80s are not really of interest for current policy. [Emer Griffin, Ireland]	Accepted. bullet point removed from revised SPM.
78735	5	1	5	4	A1.4: This statement is misleading, and would therefore rightfully draw fire. The latest climate models (CMIP6) do not in general do a good job at simulating global warming over the last 40 years. Instead many tend to overestimate the warming because they seem to have unrealistically high climate sensitivities (note: this is not primarily about errors in radiative forcing). Please remove or word more carefully. [Peter Cox, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34963	5	1	5	4	The SOD claims that over the last 40 years, models have closely predicted global actual temperature rise. Please see rebuttal comments #1, #2 and #3 above. [Jim O'Brien, Ireland]	Noted.
50093	5	1	5	4	It is not clear that 'The pattern of temperature change' refers to projections here, and so it is slightly unclear how the first and second sentence of A1.4 are connected. This could be better phrased as 'Projections of temperature change patterns and projections of the rate of warming, published since the 1980s are in close agreement with observations, especially when accounting for...'. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
42175	5	1	5	4	A1.4: Good, but technical. Potential move to TS? [Tina Christensen, Denmark]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
34503	5	1	5	4	A.1.4 is somewhat ambiguous. In particular, what time period is meant by "early climate change projections" -- e.g., those in the 1980s, or 1980s and 1990s, or something else? Likewise, does "the pattern of temperature change" mean the "projected" pattern? [Russell Vose, United States of America]	Not applicable. Bullet point removed from the revised SPM.
117197	5	1	5	4	Missing confidence statement [Maisa Rojas, Chile]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
38883	5	1	5	4	Would it be possible to say more clearly what you conclude from the close agreement? I assume it means that the pattern of change and the rate of warming have been projected correctly. Highlighting this can also increase trust in more recent projections. [Maike Nicolai, Germany]	Not applicable. Bullet point removed from the revised SPM.
9709	5	1	5	4	maybe add detail in A.1.4 of how earlier projections have been borne out by observations? [Jonathan Lynn, Switzerland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
108535	5	1	5	4	Unclear, could these lines be re-worked. I had trouble understanding what was being said. [Jason Donev, Canada]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104001	5	1	5	5	It is not very clear what the take home of this is. It suggests something like this: 1980s models already included the first-order essential processes driving climate change, pointing to an overall dominance of CO2 as a driver. A follow up question may be: why do we need more sophisticated models (next paragraph). [Philippe Tulkens, Belgium]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
8067	5	1	5	5	It is not very clear what the take home of this is. I suspect something like this: 1980s models already included the first-order essential processes driving climate change, pointing to an overall dominance of CO2 as a driver. A follow up question may be: why do we need more sophisticated models (next paragraph). [Frank Dentener, Italy]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
4543	5	1	5	15	Climate models consistently overestimate warming. Where does the overconfidence of IPCC authors come from? Considering that the CMIP-6 models have mostly failed, it would now be the right moment to backtrack from the 100% anthropogenic claim and return to a more realistic mix of anthropogenic vs. natural climate drivers. Credibility of the IPCC is seriously at risk if these issues are not addressed in a more balanced way. [Sebastian Luening, Switzerland]	Not applicable. Bullet point removed from revised SPM.

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67813	5	1	5	53	The estimation model used in the AR6 is better than the model used in AR5, with a high level of confidence. The high-resolution model used in this assesment is able to reduce bias in several aspects, but not including climate aspects in marine ecosystems where the level of confidence is still at medium level. This is due to the limited data that can be used as variables in making climate estimation models, especially at the regional scale. Changes that occurred in the past or before 1970 are also difficult to quantify consistently. Collaboration and coordination between countries and institutions / organizations need to be improved to collect more robust data to create models for the marine ecosystem. Limited information for certain regions needs to be added, especially related to marine ecosystems in the tropics. [Ruandha Agung Sugardiman, Indonesia]	Noted. The limited sampling in earlier or specific regional parts of data records are known and incorporated in the uncertainties of the assessment. Data gaps are flagged where relevant in the SPM. For example in Figure SPM.3.
87313	5	2	5	2	add after temperature change: "projected" [Marcel Berk, Netherlands]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86065	5	2	5	2	Suggest rewording "The pattern of temperature change is in close agreement with" to "Projected temperature change closely agree with" [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104003	5	2	5	2	Replace "pattern of temperature change" with "pattern of projected temperature change" [Philippe Tulkens, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
9603	5	2	5	2	surface temperature change or all temperature changes (surface, atmosphere, ocean) ? [Olivier Boucher, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129733	5	2	5	2	The phrase "the pattern of temperature change" in this sentence refers to the climate change projections, correct? If so, this phrase should be re-worded to be clearer that the pattern of projected temperature change is in close agreement with what has been observed. [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
131665	5	2	5	3	I dont understand, what specific pattern of temperature change you are talking about here. Is it "...the pattern of temperature change (predicted by the models) is in close agreement with what has since been observed? If yes, this specification would help to understand this key meassage more easily. [Hans Poertner and WGII TSU, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
132601	5	2	5	3	The observed pattern of warming since the 1970s has been pretty different from that projected by models, with differences seen in every ocean basin. There are some consistencies (such as more warming in the Northern Hemisphere than the Southern Hemisphere, more warming over land than Oceans), but the differences are a big topic of discussion in Chapter 7 since they affect the radiative feedbacks and thus assessments of ECS from the historical record. It's also discussed in Chapter 9. We need to resolve any inconsistencies between statements in Chapter 1 and Chapters 7 and 9, and to reflect that here. [Kyle Armour, United States of America]	Noted.
131667	5	2	5	4	add projected before temperature and rate of warming [Hans Poertner and WGII TSU, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
40573	5	2	5	4	No uncertainty language here, that would quantify how the IPCC projections faired? Only "close agreement" is mentioned. [TSU WGI, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25727	5	2	5	4	Other variables such as sea level rise should have also been mentioned, besides temperature change. [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
35255	5	2	5	4	The statement that the 1980s models are in agreement with what happened after allowing for observed emissions is very misleading. In the Hausfather et al 2020 paper that this refers to, indeed the GHG forcing is adjusted--and that is why Hansen's Scenario B appears to fit. But there is another radiative adjustment that needs to be made, which is to adjust his mean sulfate aerosol forcing to be less negative, consisted with the revisions to it from Bjorn Stephens. That would drop the negative forcing that Hansen used to one-third of its value, and that induces nearly 1 w/m-sq more net positive forcing, and the disagreement between this iconic model and what has been observed becomes larger than it is using the unadjusted forcing. I realize that few readers of the SPM are going to pick this up and that you won't change the text, but be advised that at least one reader sees that you attempted to (and succeeded at) misleading here. [patrick Michaels, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104005	5	2	5	5	Please specify which temperature is referred to. [Philippe Tulkens, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
101505	5	2			Change "against" to "using" [Knute Nadelhoffer, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36023	5	2			up to 40' seems stilted, and unclear, is 10 years also up to 40, maybe "over the last 40 years" leaves open that not all the indicators have a full 40 years. [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
110771	5	4	4	4	scenarios previously used [cathy clerbaux, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
131669	5	4	5	4	This statement should start with a clear message (quite successful despite limitations) [Hans Poertner and WGII TSU, Germany]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129735	5	4	5	4	"the emission scenarios they used ...": Who/what is 'they'? [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
84693	5	4	5	4	"they" who? [Annalisa Cherchi, Italy]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
101507	5	4			Change "emission scenarios they used and" to "emission scenarios used for the projections and" [Knute Nadelhoffer, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
81815	5	4			Delete "they" before "used" as this is not necessary and there is ambiguity about who "they" is referring to [Dan Zwart, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129737	5	5	39	39	Define ZJ unit. [Trigg Talley, United States of America]	Not applicable. ZJ no longer appears in the revised SPM.
129739	5	5	51	51	includes --> include [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66513	5	6	5	6	"last generation is ambiguous", it could also mean regional convection-permitting models. To be added is "global" (climate models) [Robert Vautard, France]	Not applicable. Bullet point removed from revised SPM.
42177	5	6	5	9	A1.5: Keep L6-9 [Tina Christensen, Denmark]	Taken into account. A similar statement can be found in revised box SPM.1
76915	5	6	5	11	The opening sentences can be combined to make a short clear statement on model improvements [Emer Griffin, Ireland]	Not applicable. Bullet point removed from revised SPM to shorten the SPM and focus on what matters most.
42003	5	6	5	15	Is it necessary to include this information in the SPM? We propose to transfer it to Technical Summary. [Juhani Damski, Finland]	Accepted. bullet point removed from revised SPM.
37211	5	6	5	15	Please clearly state (a) whether the models have been validated and (b) where the validation or the accuracy of models is discussed. You refer readers to section 1.5.4. but while it talks about improvements in models it fails to demonstrate that models have in fact improved (which readers might reasonably interpret as meaning that there has been no improvement). [John McLean, Australia]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
87157	5	6	5	15	Since we have explicitly been challenged to give attention to ways of shortening the SPM, we believe that the level of detail in this para (A1.5) could be reduced. E.g. to what extent is information/data from regional climate models included in the SPM? If the answer to such questions are no or limited usage you might consider to at least shorten the information regarding which features (convection, diurnal cycle, land-sea breezes and precipitation extremes) that are better captured in such models. We think it is relevant for policymakers to be aware of the existence of such models, and that they can provide more locally specific/accurate calculations, but question if it is really relevant for high-level policymakers to know why. [Oyvind Christophersen, Norway]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. (note that improvements in models are partially covered in box SPM.1)
76919	5	6	5	15	A clearer shorter statement about the development of GCMs and value of RCMs would be more useful than the current text [Emer Griffin, Ireland]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
76921	5	6	5	15	A clearer shorter statement about the development of GCMs and value of RCMs would be more useful than the current text [Emer Griffin, Ireland]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
42391	5	6	5	15	Long sentence to say that models have improved and are less biased since AR5, and that regional models add value due to higher resolution. Please shorten and simplify the language [Tina Christensen, Denmark]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
97189	5	6	5	15	The assessment of progress between CMIP5 and CMIP6 as done in Ch3 is not really convincing that the progress was substantial for the main relevant climate parameters. Please revise the confidence statement. [Nicole Wilke, Germany]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
129741	5	6	5	15	Strike the two sentences starting with "For most large-scale indicators of climate change..." and "Global high-resolution models exhibit..." to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
96901	5	6	6	25	In addition to the physical realism of climate models improving (some biases have actually gotten worse, prelim analysis), and more realistic representations of biogeochemistry (AOGCMs -> ESMs), the forcing datasets and the complexity of these forcings is another aspect which has been improved thanks largely to improving observational measurements and the data products that these have enabled. The input4MIPs project (Durack et al 2018 doi: 10.1029/2018EO101751) is an entry point into better elucidating the importance of forcing to accurately simulate observational changes. This point is also relevant for A.2.2 [Paul Durack, United States of America]	Not applicable. Bullet point removed from revised SPM.
107779	5	6			The note 5 refers to latest generation of climate models. The definition explains that it is "Models assessed within the Coupled Model Intercomparison Project Phase 6 (CMIP6)". Ok fine, but what it is more precisely, and where could I find a more complete or accurate definition of one or more models of that kind ? [FREDERIC MENARD, France]	Not applicable. Bullet point removed from revised SPM.
101509	5	6			Change "has a more comprehensive representation of physical" to "more comprehensively represents physical" [Knut Nadelhoffer, United States of America]	Not applicable. Bullet point removed from revised SPM.
65021	5	7	5	9	This is a very weak, if not misleading statement. Since only the sign of change ("improved") is given, I take from the statement that "some aspects of variability ... improved" that most did deteriorate. Unless a meaningful statement can be produced, it is not useful at this high level of the SPM. The improved skill in mean climate can be saved if the "most large-scale indicators" can become more specific. The confidence statement makes sense only if a sentence is formulated that is testable and falsifiable. [Johannes Quaas, Germany]	Taken into account . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
38885	5	7	5	10	Again - what is your conclusion from the improved ability to simulate observed changes and reduced biases? I think you would have to spell this out more clearly for policymakers. [Maike Nicolai, Germany]	Taken into account . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
27703	5	7	5	11	This is not quite true for the representation of key past climate periods. e.g. Brierley et al, Climate of the Past Discussion for the midHolocene. [Eric Brun, France]	Not applicable. Bullet point removed from revised SPM.
36025	5	7			"processes controlling the Earth system..." Something about the processes are focused on the ones that change the Earth, not minor ones. [Michael PRATHER, United States of America]	Not applicable. Bullet point removed from revised SPM.
81817	5	8			Suggest "some aspects of the variability" is changed to "some aspects of its variability" [Dan Zwart, New Zealand]	Not applicable. Bullet point removed from revised SPM.
27701	5	9	5	9	"High-resolution" could be deleted. This is not so much a function of resolution but of the general improvements in the models. [Eric Brun, France]	Not applicable. Bullet point removed from revised SPM.
9605	5	9	5	9	I would suggest to delete the "high-resolution". This is not so much a function of resolution but of the general improvements in the models. [Olivier Boucher, France]	Not applicable. Bullet point removed from revised SPM.
44697	5	9	5	10	It is not clear what "reduced biases" are compared to. Global high-resolution models applied at the time of AR5? Is this a key issue to be raised in SPM? In any case, the preceding two sentences would seem to already cover this aspect, so some shortening of the text might be feasible here. [Markku Rummukainen, Sweden]	Not applicable. Bullet point removed from revised SPM.
104007	5	9	5	11	Please clarify this sentence as "aspects of surface and ocean climate" is rather unclear (is it climate components on land surfaces and oceans?), and examples should be provided, for both cases of reduced bias and non-reduced bias. [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36027	5	9			Maybe put in that we expect higher resolution models to be more accurate and they are. I am missing the expectation here. Also, to the average govt, regional may be social focus, not just higher resolution, need to mention it somewhere. [Michael PRATHER, United States of America]	Not applicable. Bullet point removed from revised SPM.
81943	5	10	5	10	“exhibit reduced biases” probably too technical language for the SPM [Dan Zwartz, New Zealand]	Not applicable. Bullet point removed from revised SPM.
25729	5	10	5	10	Please clarify whether "surface and ocean climate" refer to land and ocean climate. [Don Alfonso Pino Maeso, Spain]	Not applicable. Bullet point removed from revised SPM.
44699	5	10	5	10	The "some but not all aspects of surface and ocean climate" is unclear, and hardly informative for the reader. Could this be adjusted into more clear message? [Markku Rummukainen, Sweden]	Not applicable. Bullet point removed from revised SPM.
46557	5	10	5	10	reference of "reduced" is unclear - maybe clearer to say "reduced biases compared to low-resolution models" if that's the intended meaning [Dirk Notz, Germany]	Not applicable. Bullet point removed from revised SPM.
19217	5	10	5	11	“Global high-resolution models exhibit reduced biases in some but not all aspects of surface and ocean climate (medium confidence).” Why “medium confidence”? It all depends on what is implied by “some but not all”. If “some aspects” in the sentence can be as few as two or three aspects, then the statement is just a fact, isn’t it? Or perhaps there should be some information regarding the number of models that show improvement? [Anne-Marie Treguier, France]	Not applicable. Bullet point removed from revised SPM.
76917	5	10	5	11	The opening sentences can be combined to make a short clear statement on model improvements. [Emer Griffin, Ireland]	Taken into account . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
108537	5	10	5	12	Unclear, could these lines be re-worked. I had trouble understanding what was being said. [Jason Donev, Canada]	Not applicable. Bullet point removed from revised SPM.
111091	5	10			this is not helpful to say that some things improve - it would be more helpful to give an example of improvements - or at least a pointer as to things that improve and things that don't [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed from revised SPM.
66515	5	11	5	11	"add value" is a "defensive" expression, as if the central question was to demonstrate added value. I would rewrite by "Regional climate models complete global models by representing many regional weather and climate...". [robert vautard, France]	Not applicable. Bullet point removed from revised SPM.
5269	5	11	5	14	Delete the portion of this sentences after “climate phenomena”. As elsewhere, I am trying to suggest ways to shorten and simplify the SPM wherever possible. [Daniel Murphy, United States of America]	Taken into account . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
69291	5	11	5	14	In Chapter 10, it runs "Simulations with non-hydrostatic RCMs at convection-permitting resolution (at 3 km and finer) improve the representation of phenomena associated with deep convection...". In order to avoid misunderstanding that all RCMs can be used to represent many regional weather and climate phenomena, adding the requirements of RCMs that are given in Chapter 10 is suggested. [Kaoru Magosaki, Japan]	Not applicable. Bullet point removed from revised SPM.
84695	5	11	5	14	better to divide into 2 sentences, one for regional models and the second one for simulations at km-scale resolution [Annalisa Cherchi, Italy]	Not applicable. Bullet point removed from revised SPM.
65023	5	11	5	14	The statement does not help the message the SPM wants to convey. What high-level conclusions are possible only thanks to the regional climate models? What is precisely the added value for key conclusions beyond the trivial one that some processes are better resolved? [Johannes Quaas, Germany]	Taken into account . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78951	5	11	5	15	This sentence is difficult to read; we suggest to split it into 2 sentences. [Martine Vanderstraeten, Belgium]	Not applicable. Bullet point removed from revised SPM.
104009	5	12	5	12	Please provide examples of complex terrain (mountainous and coastal areas, probably). [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed from revised SPM.
101511	5	12			Change "in particular over complex terrain, and simulations" to "in particular over complex terrain. Simulations" [Knut Nadelhoffer, United States of America]	Not applicable. Bullet point removed from revised SPM.
25731	5	13	5	13	An explanation of the concept "representation of convection" should be included. [Don Alfonso Pino Maeso, Spain]	Not applicable. Bullet point removed from revised SPM.
86067	5	14	5	14	Add "yielding useful information for cities" [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Bullet point removed from revised SPM.
104011	5	14	5	14	Explain why this is important: to better quantify impacts, and provide information for adaptation strategies. It would be nice to understand what exactly these better models are able to quantify better. [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
8069	5	14	5	14	Explain why this is important: to better quantify impacts, and provide information for adaptation strategies. It would be nice to understand what exactly these better models are able to quantify better. [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
29387	5	14	5	14	urban heat island as local phenomena [Joachim Fallmann, Germany]	Not applicable. Bullet point removed from revised SPM.
15369	5	15	5	15	Section 11.7 (or more specifically 11.7.1.3 and 11.7.3.3) should be added as a related section for the advantage of high-resolution models. [Masaki Satoh, Japan]	Not applicable. Bullet point removed from revised SPM.
42345	5	16			Recommend to further present the concept of "Water-cycle" [Tina Christensen, Denmark]	Not applicable. Bullet point removed from revised SPM.
81945	5	17	5	18	Would also be interesting to note any applicable FAR statement (or add "first" to the SAR statement.) [Dan Zwart, New Zealand]	Not applicable. The history of assessments of human influence on the climate in IPCC report has been removed from the SPM, for conciseness and to focus on what matters most: the assessment of AR6.
90729	5	17	5	18	In order to refer exactly to the discovery of the SAR, write: "The IPCC Second Assessment Report (1995) found that the balance of evidence suggests a discernible human influence on global climate." [José Romero, Switzerland]	Not applicable. The history of assessments of human influence on the climate in IPCC report has been removed from the SPM, for conciseness and to focus on what matters most: the assessment of AR6.
110773	5	17	5	19	why spell SAR and not the others [cathy clerbaux, France]	Not applicable. Bullet point removed from revised SPM.
112187	5	17	5	20	I think a big opportunity is missed here in not capturing the banner of the key finding from each of the prior Assessments. Each Assessment has laid down unique markers which became important steps in advising policymakers on the advances in the scientific basis. It is important to recognize each Assessment in an equanimous manner i.e., each yielded results of significance. The progressive advances provided by each Assessment have collectively brought the knowledge strength to where it is now. If the concern is that this will make it too wordy, 'box' it or 'table' it - that tends to have a better visibility too. From another point of view, speaking in detail only about SAR and AR5 gives a convoluted sense as if nothing important was found in the other Assessments. One could argue that TAR and AR4 also had huge banner headlines, comparable to SAR and AR5. I suggest avoiding giving this impression, even if it is inadvertent. It could be misperceived. [venkatachalam ramaswamy, United States of America]	Not applicable. The history of assessments of human influence on the climate in IPCC report has been removed from the SPM, for conciseness and to focus on what matters most: the assessment of AR6.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
64783	5	17	5	24	As a policy maker, this passage stands out as striking and convincing. If possible, consider a subheading or call-out with language that indicates it is established fact in AR6 that human activity has altered the climate system since the mid-20th century. [Casey Kopcho, United States of America]	Noted. The 'established fact' is now more prominent as it is in the opening headline statement (HS1) of the revised SPM.
27705	5	17	5	24	There is no uncertainty language used. [Eric Brun, France]	Noted. No uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact.
81741	5	17	5	24	there is no uncertainty language used [Karina von Schuckmann, France]	Noted. No uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact.
104013	5	17	5	24	Paragraph A.1.6 if the most policy-relevant paragraphs of this section, and should be the 1st paragraph of section A of the SPM. [Philippe Tulkens, Belgium]	Taken into account. The 'established fact' is now more prominent as it is in the opening headline statement (HS1) of the revised SPM.
104015	5	17	5	24	This paragraph is essentially saying that our confidence of rapid changes (5 decades) in the climate system has increased over the sequence of IPCC reports. However, it would be more instructive to state what exactly we know better now. [Philippe Tulkens, Belgium]	Taken into account. Bullet point removed from revised SPM.
78955	5	17	5	24	We already understood from AR5 that human influence on the climate was fully established. We suggest that the language used here should take that into account and thus avoid suggesting that it is now "more" of "an established fact" than before. We think that what is new here is the additional data, and that it is useful to state that this new data confirms the evaluation done in AR5. However, the evaluation itself just did not change: human influence on the climate was, and still is, an established fact. [Martine Vanderstraeten, Belgium]	Taken into account. AR5 assessed the human influence as extremely likely while this report ('It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.'). On the other hand, this report presents human influence as an established fact, which is stronger than before. We hope that the revised HS1 is now clearer.
86899	5	17	5	24	Please consider to delete the first sentence of this para A.1.6. We think we understand the rationale for having it included, but feel it would be more policyrelevant to include at the end of the para a new sentence that describes quantitatively or semi-quantitatively how much of the already observed changes in temperature that can be attributed to human activities/influence. Is it for instance now an established or undisputable fact that human influence can explain most of the temperature increase experienced since preindustrial times? If so, write so, and if possible be as quantitative as possible. [Oyvind Christophersen, Norway]	Taken into account. Bullet point removed from revised SPM.
76923	5	17	5	24	There is no need to run through the history of IPCC statements. Just state further data and analysis expands and enhances the findings of the Ar5 on the human impacts on the climate system [Emer Griffin, Ireland]	Taken into account. Bullet point removed from revised SPM.
76925	5	17	5	24	A clear short statement on more data etc since the Ar5 and human influences are now better quantified [Emer Griffin, Ireland]	Noted.
8071	5	17	5	24	This paragraph is essentially saying that our confidence of rapid changes (5 decades) in the climate system has increased over the sequence of IPCC reports. However, it would be more instructive to state what exactly we know better now. [Frank Dentener, Italy]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
4541	5	17	5	24	The 100% anthropogenic attribution does not reflect current scientific understanding. Significant natural warming rebound after the Little Ice Age is to be expected. Warming through CO2 during the early 20th century is limited. We are attributing a significant part of the warming 1980-2000 to multidecadal natural variability (PDO, AMO) which is neglected here. Climate models consistently overestimate warming. Where does the overconfidence of IPCC authors come from? Considering that the CMIP-6 models have mostly failed, it would now be the right moment to backtrack from the 100% anthropogenic claim and return to a more realistic mix of anthropogenic vs. natural climate drivers. Credibility of the IPCC is seriously at risk if these issues are not addressed in a more balanced way. [Sebastian Luening, Switzerland]	Rejected. Over the timeframes stated in the SPM (1850-1900 to 2010-2019), all of the observed warming is the result of human activities - as shown in the updated Figure SPM.2. Internal Variability has been included in this assessment.
42179	5	17	5	24	A1.6: The last sentence is key. Perhaps keep this as is, if reference to former reports is reduced in the remaining text [Tina Christensen, Denmark]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers. Note however that the last sentence is reflected in the headline statement HS1
129743	5	17	5	24	Tighten this section by merging the first two sentences together to read "Since the IPCC Second Assessment Report (1995) and throughout subsequent assessments, the evidence for human influence..." [Trigg Talley, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
81881	5	17	5	24	The key statement is in the last line of the paragraph. It should be at the top of the paragraph [Dan Zwart, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers. Note however that the last sentence is reflected in the headline statement HS1
9711	5	17	5	24	A.1.6 seems to have some duplication with A.1.2 - this section shows the advance of the various assessments [Jonathan Lynn, Switzerland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers. Note however that the last sentence is reflected in the headline statement HS1
41283	5	18	5	20	Please reconsider which reports are mentioned. Why highlight SREX and not SRCCL or SROCC. Probably, sticking to the major assessment reports/cycles in this context would be most advisable. [Alexander Nauels, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers. Note however that the last sentence is reflected in the headline statement HS1
37215	5	18	5	20	Your sentence is utterly laughable. Each IPCC report changes its so-called evidence because what it previously claimed to be evidence has been shown to be wrong, sometimes by IPCC reports themselves. The Hockey Shtick temperature graph was discredited; claims based on climate models fell apart when the AR5 showed how flawed climate models really are. What's more AR5 showed that despite the increase in CO2 over the previous 15 years there was no certainty that any warming had occurred, which undermines your basic notion that increasing CO2 causes warming. Regardless of how much spin you try to put on it, you are being dishonest to claim that the IPCC evidence for a human influence has strengthened. [John McLean, Australia]	Rejected. The underlying chapters of the report explain in detail where evidence for human caused climate change has strengthened.
90731	5	18	5	24	Please check the exact wording of each of the foundations of the ARs for these references, as we have done for our previous comment. [José Romero, Switzerland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
11579	5	20	5	20	Aren't model-based attribution studies an important piece of evidence for this attribution? Shouldn't these be mentioned here? [Gerhard Krinner, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27707	5	20	5	20	We suggest to divide this into 2 sentences to reinforce the message. Would thus read: "...on the climate system is clear. It is evident from ..." [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
101513	5	20			Change "clear, evident from" to "clear, as evident from" [Knut Nadelhoffer, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
112189	5	21	5	21	"net positive radiative forcing" [venkatachalam ramaswamy, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
99945	5	21	15	31	An explanation for the regions, ie NPO, SOO etc., shown in Figure SPM.6 so the ready can understand what those identifiers represent. [Dan Helman, United States of America]	Taken into account. In the final (approved) version of the SPM, figure SPM.3 includes a list of the abbreviations used for each region.
112141	5	22	5	24	Same comment as for the page before - when does overwhelming evidence become fact? [Timothy Carter, Finland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
81947	5	22	5	24	This sentence could be clearer that the "alteration" is non-trivial (in fact, the main cause in some variables) [Dan Zwartz, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
24113	5	22	5	24	This sentence is inconsistent with the Chapter 3 ES assessment and fails to protect the integrity of the attribution assessment made there. As I said in comment above, the SPM (and the chapter 3 ES) could make more of AR6 attributing changes since the "pre-industrial" proxy of late 19th century. [Peter Stott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Chapter 3 revised its assessment to 'unequivocal', which can be used interchangeably with 'established fact', as both denote statements of facts and reference to mid-20th century removed from HS1.
87361	5	22	5	24	The wording 'established fact' in the sentence '...human influence on the climate system... is now an established fact' communicates well, however these wording is not used the underlying chapters. In ch 3 ExSum page 3-4 line 10 and 3.8.1, pag 3-76 line 8, the qualifier 'virtually certain' in italics is used, consistent with the consolidated IPCC uncertainty language.. Moreover, 'established fact' and 'virtually certain' have slightly different meanings. An SPM must be based for 100% on the underlying chapters. Since the statements of the IPCC on human influence on climate are one of the most cited ones and are the basis of all climate change policy, utmost care needs to be taken in the wording. I suggest either adjust the text in chapter 3, or (better) adjust the statement here and use 'virtually certain'. [Marcel Berk, Netherlands]	Taken into account. Chapter 3 revised its assessment to 'unequivocal', which can be used interchangeably with 'established fact', as both denote statements of facts.
31573	5	22	5	24	Current version of chap 3 SOD assesses human influence as virtual certain, not « fact ». There should be consistency [Jean-Baptiste SALLEE, France]	Taken into account. Chapter 3 revised its assessment to 'unequivocal', which can be used interchangeably with 'established fact', as both denote statements of facts.
80479	5	22	5	24	The wording 'established fact' in the sentence '...human influence on the climate system... is now an established fact' communicates well, however these wording is not used the underlying chapters. In ch 3 ExSum page 3-4 line 10 and 3.8.1, pag 3-76 line 8, the qualifier 'virtually certain' in italics is used, consistent with the consolidated IPCC uncertainty language.. Moreover, 'established fact' and 'virtually certain' have slightly different meanings.. An SPM must be based for 100% on the underlying chapters. Since the statements of the IPCC on human influence on climate are one of the most cited ones and are the basis of all climate change policy, utmost care needs to be taken in the wording. I suggest either adjust the text in chapter 3, or (better) adjust the statement here and use 'virtually certain'. [Leo Meyer, Netherlands]	Taken into account. Chapter 3 revised its assessment to 'unequivocal', which can be used interchangeably with 'established fact', as both denote statements of facts.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130437	5	22	5	24	A.1.6 "Human influence on climate has played the dominant role in observed warming since the 1950s" is not exactly reflect the statement in the underline chapter. It is suggested change it to "The evidence is now even stronger and it is an established fact that human influence on climate has played the dominant role in observed warming since the 1950s." [Panmao Zhai, China]	Not applicable. Bullet point removed from revised SPM.
38281	5	22	5	24	This sentence is inconsistent with the underlying report. Lines 46-47 on page 75 of Chapter 3 in the underlying report is expressed as: "human influence on climate has played the dominant role in observed warming since the 1950s". Human influences have played the "dominant role" in the climate, but "have not changed" the climate system. In the other sections of Chapter 3 do not appear either such expressions as "Human activities have changed the climate system". Therefore, it is suggested to change this sentence to: "This evidence is now even stronger and it is now an established fact in AR6 that human influence on climate has played the dominant role in observed warming since the 1950s". [Yaming LIU, China]	Taken into account. Chapter 3 revised its assessment to 'It is unequivocal that human influence has warmed the global climate system since pre-industrial'. 'unequivocal' can be used interchangeably with 'established fact', as both denote statements of facts.
50095	5	22	5	24	This sentence is inconsistent with the Chapter 3 ES assessment and fails to protect the integrity of the attribution assessment made there. I propose it should be replaced with a formulation that includes the sentence at Chapter 3 page 4 line 10 "It is virtually certain that human influence has warmed the global climate system" such as : "AR5 concluded that it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. This evidence is now even stronger. It is virtually certain that human influence has warmed the global climate system." [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Chapter 3 revised its assessment to 'It is unequivocal that human influence has warmed the global climate system since pre-industrial'. 'unequivocal' can be used interchangeably with 'established fact', as both denote statements of facts.
109291	5	22	5	24	Suggest replacing the first part of the sentence by: "This evidence is even stronger in AR6. It is now an established fact..." Reason: "an established fact in AR6" sounds like it is only a fact in AR6. I think the "established fact" statement stands by itself independent of this report. Also, please add a reference to Chapter 1 section 1.3, which discusses all of this in detail. [Paul Edwards, United States of America]	Not applicable. Sentence no longer appears in revised version
76783	5	22	5	24	The wording here isn't as clear as in the headline statement, and it could be read that human's have only influenced the climate since the mid-20th Century. [Nerilie Abram, Australia]	Taken into account. Reference to mid 20th century removed from headline statement HS1
3577	5	22	5	24	If the report describes as "established fact", confidence level should be "virtually certain" of "extremely likely" whereas there is no confidence level is shown. Please add the level. [Mitsutsune Yamaguchi, Japan]	Rejected. No uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact. This is the case here
9471	5	22	5	24	This is a critically important statement. We need to remember our audience here. I suggest rephrasing for clarity e.g. For the first time in IPCC history AR6 concludes that it is now an established fact that human activity has altered the climate system since the mid-20th century. Another alternative could be: AR6 presents multiple lines of evidence that demonstrate that it is now an established fact that human activity has altered the climate system since the mid-20th century. [Joelle Joelle Gergis, Australia]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. (But HS1 which contains part of this information has been revised for clarity).
86069	5	23	5	23	"an established fact" is much better wording than "unequivocal" used elsewhere, and must appear early in SPM and frequently throughout. Good, it is used in A1 headline statement! [Debra Roberts and the Durban WGII TSU, South Africa]	Noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37219	5	23	5	23	It is a subjective and false claim to say that it is an established fact that human activity has altered the climate system. (see comment above for lines 18 to 20 of this same page.) [John McLean, Australia]	Rejected. No uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact. This is the case in here.
111625	5	23	5	24	This is a curious statement. It is saying something with even greater certainty than previous ARs (in fact with absolute certainty!), but the actual statement (human activity has altered the climate system) is rather weak. My immediate reaction to the statement is 'so what?' Previous statements on attribution of observed change have been stronger (attributing amounts of the observed warming) but at lower confidence levels - but nevertheless at confidence levels that are high enough to establish the importance of the problem. There are diminishing returns from trying to establish human influence at ever higher levels of certainty, when previous ARs have already done this to a high enough level that the policy questions have moved on to ask what society needs to do about the risks from future change. Indeed there is a danger in weakening the assessment of human influence in order to get something that can be agreed as 100% certain instead of 95%. I don't disagree with the statement but I'm not sure it adds any value here. I suggest a preferable focus for this paragraph might be to point to the increasing evidence of anthropogenic change across multiple elements of the climate system. This would link better with Figs 1 and 2. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54587	5	23	5	24	Similar to the comment on the headline for Section A.1, we urge the authors to find an alternate way to communicate that the understanding of human influence on the climate system has strengthened. The introduction of a limited time period for which human influence on the climate system is unequivocal makes this sound like a weaker finding than in the AR5 or revised headline B2 in the Corrigendum. [Nancy Hamzawi, Canada]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
42393	5	23	5	24	consider moving key message to the top of the section [Tina Christensen, Denmark]	Taken into account. The 'established fact' is now more prominent as it is in the opening headline statement (HS1) of the revised SPM.
132603	5	24	5	24	This should point to Chapter 7 Section 7.3.5 as well. [Kyle Armour, United States of America]	Accepted. HS1 refers to 7.3
42005	5	27	5	27	FIG SPM.1: Please, consider reducing the number of time series presented to make the figure clearer to read (larger font, thicker lines). This figure could contain relevant information from FIG SPM.2, so that FIG SPM.2 can be deleted. [Juhani Damski, Finland]	Taken into account. Fig SPM.1 and SPM.2 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
90733	5	27	5	27	FIGURE SPM.1: We agree that phenological indicators are useful. Would it be possible to include a second one? [José Romero, Switzerland]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65495	5	27	5	42	Suggest clarification. The text on Page 2 says GSAT will be used as the principal surface temperature metric, but Figure SPM 1 shows GMST. Suggest a caption and/or associated text to explain. [Kushla Munro, Australia]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
65497	5	27	5	42	Suggest clarification. Figure SPM 1 has two different time scales. Suggest splitting into two different figures: one with 1850 to 2020; one with 0 to 2000. The two time scales will be confusing to non-scientific readers. The historical references (Tyndall, Watt, et al.) are unnecessary and distracting. These can be removed as they do not refer to any actual events in the climate system. The cherry blossom bloom date is a completely different phenomenon from the other physical indicators and can be removed. Suggest this be included in the WGII report, instead. [Kushla Munro, Australia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
42185	5	27	5	47	Fig SPM1 + 2: Good figures, supplement each other well [Tina Christensen, Denmark]	Noted with thanks
42639	5	27			Fig SPM.1 : The inclusion of Kyoto cherry blossom is questionable. Single location timeseries are hard to attribute. Has a published attribution study been carried out to show that this is indeed due to climate change? If not, suggest it should probably be removed. Comment also applies to Fig SPM.2. Are there more widespread biological indicators, where formal attribution has been done, that can be used? [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Fig SPM.1 and SPM.2 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42641	5	27			Fig SPM 1: It would be useful for the instrumental record of GSAT to also be included alongside GMST (since GSAT is the principal variable used in the report). [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
42181	5	27			Fig SPM1 - how is the calculation of the 1.1 C warming? Centered mean on 2018 or 1-yr (end-year) comparison [compared to SR15 30-year estimate] [Tina Christensen, Denmark]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however estimate warming of 1.09°C along with the details are provided in HS1.2.
28103	5	27			Regarding Figure SPM.1: - From a scientific and communication point of view, we consider that a local variable, such as the Kyoto cherry blossom date, should not be considered in the same figure as other representative key climate variables. Indeed, the underlying Chapter does not discuss the representativeness of this variable, for example as regards to the potential attribution of the trend to the Kyoto area progressive urbanization. Furthermore, there are probably more representative indicators of the general behaviour of the biosphere in a changing climate, such as the trend in the seasonal characteristics of the NDVI in extratropical regions during the last decades. We also noticed that all indicators, except this one, are commented in the legend. - On graph, we can only see those 2 legends : "paleo-GMST" and "GMST increasing". It's not possible to say if HadCRUT5 is used for paleo-GMST or for "increasing GMST". Also, the acronym GMST should be explained in the legend; what are HadCRUT5, PAGES2K and RSS should also be reminded in the legend. - All y-axis for the 'Instrumental period' should be on the right side of the figure, otherwise it very hard to read. - Instead of using energy to quantify the oceans warming, the use of Celsius degrees would be more understandable for policy makers. - We recommend to change "sea ice" into "sea ice extent". [Eric Brun, France]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
42183	5	27			Fig SPM1: suggest to remove historical horizons from figure [Tina Christensen, Denmark]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
31799	5	29	5	29	If global surface air temperature (GSAT) is used as the principal surface temperature metric throughout this report should this also be include figure Figure SPM.1. ? [Izidine Pinto, South Africa]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
104017	5	29	5	29	Mention the use of data-only, models, and models constrained by observations. Whye is GMST instead of GSAT used here? While all other data are global, the use of cherry blossom flowering data should be explained. [Philippe Tulkens, Belgium]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8073	5	29	5	29	Mention the use of data-only, models, and models constrained by observations. Whye is GMST instead of GSAT used here? While all data are global, the use of cherry blossom flowering data looks a bit awkward. [Frank Dentener, Italy]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
71321	5	29	5	29	Change "The intent of this figure is to highlight that ..." to "This figure highlights how ..." (ie use more definite and direct language). [David Wratt, New Zealand]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
109293	5	29	5	30	I'd simplify this sentence by deleting everything before "Multiple climate indicators." Doesn't the rest of the caption already clearly identify the figure's intent? [Paul Edwards, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
86553	5	29	5	42	It would be better to show all GMST datasets (or an envelope), not just HadCRUT5. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
12097	5	29	5	42	Tyndall has to be replaced by Eunice Foote, who did what Tyndall did 5 years earlier in 1956 - book by David Suzuki [Prabir Patra, Japan]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.</p>
37217	5	29	5	42	This is another nonsense graph that refuses to accept that data coverage has increased slowly over time. I assume that you are tying to imply that all of these changes are due to human influences, but that's dishonest when you fail to remove natural factors such as oceanic oscillations, volcanic eruptions and even shifts in Earth's position relative to the sun. [John McLean, Australia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
37223	5	29	5	42	The plot is not of GMST but of temperature anomalies and no, the terms are not interchangeable. [John McLean, Australia]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note that in figure SPM.8, the term 'global surface temperature CHANGE' is now used.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37225	5	29	5	42	The figure is duplicitous because it fails to make clear the global coverage of all of the plotted data. On what grounds do you claim that the data is global during periods of low and inhomogenous coverage? During 1850 to 1900, in particular through the 1860s and 1870s, the northern hemisphere average temperature anomalies were heavily biased by the amount of temperature data from Europe, recovering from the Little Ice Age, and the Southern Hemisphere data heavily biased by the amount of data for the shipping routes through the South Atlantic to south east Asia. I refer you to section 4.5 of "An Audit of the Creation and Content of the HadCRUT4 Temperature Dataset" (2018) which discusses this. The facts are easily established by examining the number of months in which the HadCRUT4 grid cells reported data. Further, you fail to take into account the more than 70 uncertainties in the temperature record that the above audit identified, some of which likely lead to excessively cool temperatures early in the record. (And it would be hypocrisy to dismiss this audit when it was published prior to many references cited in 6AR and the lists of references often contain material that was not peer-reviewed (e.g. reports, chapters of books). [John McLean, Australia]	Not applicable. Figure removed from the revised SPM. Note however that the limited sampling in earlier parts of the record is known, and incorporated in the uncertainties of the assessed global surface temperature.
87243	5	29	5	42	In the caption of Figure SPM.1 GMST. This should be GSAT as principal temperature metric according to BOX SPM.1 [Marcel Berk, Netherlands]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
6349	5	29	5	42	The label "Troposphere warming" in Figure SPM.1 should be changed to "Lower tropospheric warming". [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
37627	5	29	5	42	Where can we find the source for the Kyoto cherry blossom data? [Masahide Kimoto, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
108177	5	29	5	44	Figure SOM.1 Is this meant to be description of what this figure will contain, or this the figure caption? If the latter, the caption must be radically re-worked to clearly describe the point of the figure and the takeaway message from it. (This comment holds for all such figure descriptions in the SPM) [Anton Holland, Canada]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
84697	5	29	5	52	Fig SPM.1 and SPM.2 seem to contain same information, maybe just one of the two could be enough? In Fig. SPM.2 (if kept) it would be useful to indicate the period corresponding to the % of change highlighted for the different variables [Annalisa Cherchi, Italy]	Accepted. Fig SPM.2 has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41285	5	29			Fig SPM.1: why do you show GMST if you highlight the AR6 choice of using GSAT in Box SPM.1? Please swap with GSAT or at least add GSAT. [Alexander Nauels, Germany]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
101515	5	29			Change "The intent of this figure is to highlight that multiple climate indicators show that" to "This figure highlights the multiple climate indicators showing that" [Knut Nadelhoffer, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
36029	5	29			Great figure, needs some cleanup but it works well. Why does this have GMST when just above the box says we are moving to GSAT? [Michael PRATHER, United States of America]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
80069	5	31	5	32	Title of the figure could be this instead: "Indicators from all components of the Earth System:..." [Lilian Fejes, Hungary]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
9765	5	33	5	33	some of these abbreviations are explained but not all -- PAGES2k? [Jonathan Lynn, Switzerland]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
37781	5	33	5	33	In the Figure SPM.1 on p.45, it is expressed as 'Troposphere warming'. But it is expressed as 'global lower tropospheric temperature' in the explanation below. Check if the 'lower' expression is correct here. [Junhee Lee, Republic of Korea]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44701	5	33	5	33	"Kyoto cherry blossom date" would seem to a one of many possible specific examples, and likely rather unfamiliar to many. It is unclear why it has been identified for this illustration. [Markku Rummukainen , Sweden]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
69293	5	33	5	33	Kyoto cherry blossom date is the only site-specific and regional data in this figure, and subject to the influence of the heat island effect. Inclusion of estimate of the contribution from heat island, if any, would be appropriate. [Kaoru Magosaki, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
34505	5	33	5	33	Forgive the pun here, but It seems like cherry-picking to include a site-specific indicator (i.e., the Kyoto cherry blossom date time series) in Figure SPM.1, which otherwise consists of large-scale (e.g., global, Arctic) indicators. While I understand the desire to include a biospheric indicator in this figure (I'm the lead-author of the terrestrial biosphere material in Chapter 2), a site-specific indicator is probably not the best choice, as it is certainly possible to find other site-specific series that do not depict warming. [Russell Vose, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
15371	5	34	5	34	What is "RSS"? [Masaki Satoh, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
18701	5	34	5	34	Expand RSS. [Govindasamy Bala, India]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
87245	5	34	5	34	GSAT should be used here instead of GMST according to BOX SPM.1 [Marcel Berk, Netherlands]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42347	5	34			GMST used - not GSAT. What is the correlation btw these terms? [Tina Christensen, Denmark]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
44703	5	35	5	35	The steam engine is a key moment in human influence on climate, but not so in climate science. It is not obvious what the authors are aiming at here. [Markku Rummukainen, Sweden]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
9763	5	36	5	36	in fig SPM.1 legend of course we should mention John Tyndall but maybe it's time for the IPCC to also recognize Eunice Foote who got there in 1856? Women in Science! [Jonathan Lynn, Switzerland]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.</p>
111433	5	36	5	36	John Tyndall was certainly a key player, but it would be great to recognise Eunice Foote here, a woman whose work pre-dated Tyndall's by a few years but who has been largely left out of the history books because of her gender. [James Renwick, New Zealand]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.</p>
37221	5	37	5	37	And in 1906 Arrhenius revised his estimate of warming caused by a doubling of CO ₂ from 5.4C down to 1.9C, which is a significant reduction that makes this a key moment in history. [John McLean, Australia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
131671	5	39	5	39	In this graphic and in the caption it is said that SLR rose by 18 cm since 1900. However, in the related key message B.3.2. it is stated that "Global mean sea level (GMSL) has risen by 0.19 m ..." What is the correct figure? Please check the SPM and all related figures for consistency. [Hans Poertner and WGII TSU, Germany]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
97191	5	39	5	39	Caption Fig SPM.1: The enormity of this energy amount (430ZJ) is beyond imagination. What is its equivalent to in every day world units? E.g. world energy production as in TS-73-46 "For comparison world primary energy production was around 7 ZJ over the 2006-2018 period." Please consider to move this information to the main text of section B.1. [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
81907	5	39	5	39	Statement presented here "global sea level rose by 18 cm since 1900", differs to SPM-12 line 27: "Global mean sea level (GMSL) has risen by 0.19 m (likely 0.15-0.22 m) between 1900 and 2018" [Dan Zwart, New Zealand]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.

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108539	5	39	5	39	Space between number and unit [Jason Donev, Canada]	Editorial. Professional copy-editing to be done prior to publication. This kind of issues will be fixed then (if not sooner).
70319	5	39			As SPM is meant for policy makers, it is better to translate all energy unit, such as ZJ, into easy to understand language. [Masako Konishi, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
86555	5	40	5	40	Please check. Section B2.1 says GSAT increased by 1.1°C over the same period. GMST increase must be slightly lower. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
26167	5	40	5	40	What is a definition of "paleo GMST"? [Toshihiko Takemura, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
9473	5	40	5	41	I think you need to remember our audience here and just present one metric of temperature for clarity. Most people have heard of 1.1C above pre-industrial, the lower estimates are likely to be confusing. Suggest removing those from the figure and just focus on the single figure of 1.1C. [Joelle Joelle Gergis, Australia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
89643	5	40	5	41	Since it has been explicitly stated in Box SPM.1 that GSAT is the primary metric of surface temperature change, it would be good to explain why GMST is used here [Trude Storelvmo, Norway]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97193	5	40	5	41	Caption Fig SPM.1: What is the difference between both GMSTs for the same period (1850-2000). Or has GMST risen by 0.45°C between 2000-2018? [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
39523	5	40	5	42	The INCREASE of Antarctic sea ice extent should be added in Fig SPM.1 (www.pnas.org/cgi/doi/10.1073/pnas.1906556116), otherwise it would be cherry picking. [François Gervais, France]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that HS1.5 states that 'Antarctic sea-ice area has experienced no significant overall change since 1979'.
104361	5	40			What does paleo GMST mean? [Finnveden Göran, Sweden]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
54589	5	41	5	41	Clarify which part of the troposphere warmed by 0.67°C. Lower troposphere (e.g. 0 to 6 km) or entire troposphere? [Nancy Hamzawi, Canada]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
69295	5	41	5	41	The time period corresponding to "the satellite era" should be explicitly described in year. [Kaoru Magosaki, Japan]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note that the term 'satellite era' is no longer mentioned in the revised SPM.
46559	5	41	5	41	I could not find reference to a 35 % reduction in sea ice in the sections indicated here. Please consult with ch.2 and 9 on this number and its source. In particular, please use sea-ice area as the primary metric (not sure if this is the case here). [Dirk Notz, Germany]	Accepted. Sea ice area is now used
46561	5	41	5	41	Please indicate which quantity the figure shows for sea ice, also in the figure itself (ideally: sea-ice area as used in ch. 2 and 9) [Dirk Notz, Germany]	Taken into account. Sea ice area is now used
12185	5	42	5	42	"Sea Ice declined in the Arctic in summer by 35% since 1979." The number is correct, but is not introduced in neither Chap2 or Chap9. I would suggest to review this sentence with Chap2 and Chap9 authors so that it can use the same vocabulary (e.g. sea-ice area, not just sea-ice) and ideally it is introduced in one of these chapters, as a fundament for the SPM. [Thomas Laverigne, Norway]	Not applicable. This text no longer appears.
42007	5	47	5	47	FIG SPM.2 mostly replicates information of SPM.1. Furthermore, the different changes represent different periods (e.g., air temperatures vs. surface temperatures), making the figure prone to misinterpretation. [Juhani Damski, Finland]	Accepted. Fig SPM.2 has been removed.
104703	5	47	6	1	"in figure 2, below each system change label, I would add the time references to which each change of the Earth System refers to. This in order to make the figure and the key messages more clear and direct to the observer" [Andrea Bianchi, Italy]	not applicable. Fig SPM.2 has been removed.

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28105	5	47			Regarding Figure SPM.2: - This figure is very clear and very relevant. - Like Figure SPM.1, instead of using energy to quantify the oceans warming, we think that the use of Celsius degrees would be more understandable for policy makers. - Like Figure SPM.1, from a scientific and communication point of view, we consider that a local variable, such as the Kyoto cherry blossom date, should not be considered in the same figure as other representative key climate variables. Indeed, the underlying Chapter does not discuss the representativeness of this variable, for example as regards to the potential attribution of the trend to the Kyoto area progressive urbanization. Furthermore, there are probably more representative indicators of the general behaviour of the biosphere in a changing climate, such as the trend in the seasonal characteristics of the NDVI in extratropical regions during the last decades. We also noticed that all indicators, except this one, are commented in the legend. - We also noticed a typo : in the SPM (page 12 line 27), it is indicated that Sea Level Rise is not +18 but +19cm. - It would be very useful to insert the reference period for each variable. [Eric Brun, France]	Noted but not applicable. Fig SPM.2 has been removed.
42187	5	47			Fig SPM2: Define periods of trends here as in Fig SPM1 [Tina Christensen, Denmark]	not applicable. Fig SPM.2 has been removed.
41225	5	49	5	49	Need to make clear that sea ice refers to Arctic [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	not applicable. Fig SPM.2 has been removed.
71323	5	49	5	49	Change "The intent of this figure is to summarise change ...and to include ..." to "This figure summarises changes ... and includes ..." (ie Use more definite and direct language). [David Wratt, New Zealand]	not applicable. Fig SPM.2 has been removed.
34507	5	49	5	49	Figure SPM.2 contains the same problem as Figure SPM.1 -- i.e., the Kyoto cherry blossom time series (a local-scale indicator) is included on a figure which otherwise contains only large-scale indicators. [Russell Vose, United States of America]	not applicable. Fig SPM.2 has been removed.
109295	5	49	5	49	Suggest "This figure summarises...." Doesn't the rest of the caption already clearly identify the figure's intent? [Paul Edwards, United States of America]	not applicable. Fig SPM.2 has been removed.
9767	5	49	5	52	the legend to Fig. 2 could make it clear that it represents in another way what was already shown in Fig 1, or at least relates to it [Jonathan Lynn, Switzerland]	not applicable. Fig SPM.2 has been removed.
104019	5	49	5	52	No added value compared to Figure SPM.1 [Philippe Tulkens, Belgium]	Accepted. Fig SPM.2 has been removed.
8075	5	49	5	52	No added value compared to Figure SPM.1 [Frank Dentener, Italy]	Accepted. Fig SPM.2 has been removed.
65499	5	49	5	53	Suggest clarification. The inclusion of 'air temperature' is confusing without some explanation of how it is different from GMST (which again confuses as earlier text says GSAT would be adopted as principal indicator). This figure does not summarise change across all components of the Earth system. Suggest changing caption to say the intent is to "summarise change across major components of the Earth's climate system", rather than all components. [Kushla Munro, Australia]	Not applicable. Figure no longer exists in the revised SPM.
36031	5	49			This is a difficult figure, to keep everyone happy you have to include too much. Why not CH4? Why not ocean pH? [Michael PRATHER, United States of America]	not applicable. Fig SPM.2 has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
116075	5		5		A1.6 : since "at least?" the mid-20th century (please check since when human activity has altered the climate system) [Valerie Masson-Delmotte, France]	Taken into account. Reference to mid 20th century removed from headline statement HS1
17437	6	1	7	7	Should there be some reference to extremes in this section given the points made in B.5 about regional scale. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Structure of the SPM significantly revised.
104021	6	1	7	7	Section A2 is too long and technical for policymakers. Its key point appears to be that this is lots of evidence for different climate phenomena having emerged from the boundaries of natural variability. This does not require a whole page and can be incorporated into relevant parts of Section B. [Philippe Tulkens, Belgium]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structured SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
129745	6	3	6	50	This section makes no mention of detected changes in extreme heat or precipitation events. Some of these changes (especially in extreme heat) are detectable and should be mentioned. [Trigg Talley, United States of America]	Noted and taken into account in the revised structure of the SPM. A specific HS (HS3) is now devoted to "extremes" and their changes in response to human influence.
76947	6	3	7	7	This section is too technical for an SPM. What are the messages for policy? How should this influence decision making? [Emer Griffin, Ireland]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
97195	6	3	7	7	Section A.2 provides information about human induced change from global to regional scales, and we highly appreciate the clear way it is presented. This is however less obvious in its title, please consider one that better reflects the content of the section. In addition, we would suggest to also mention the shift of climatic zones towards the poles and uphill, that was shown in the SRCCL-SPM-A2.6, and the changes in snow cover as shown in the underlying report. [Nicole Wilke, Germany]	Not applicable anymore. Headline statement (red box) removed and SPM structure completely revisited. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion related to climate shift is too detailed for the revised headline statements. Regarding changes in "snow cover", these have been now mentioned in HS1.5
27709	6	3			It is often very unclear in section A2 wether sentences refer to natural or to human-induced variability, and the relative scale of the two phenomenon. [Eric Brun, France]	Noted and taken into account in the dispatching of the A2 headline statements through the new structure of the SPM. Special attention has been paid in the revised SPM to assess human-caused changes more clearly with respect to their modulation by internal variability
27711	6	3			A2 has a strange content. Near-term projections are mentioned for precipitation patterns and sea level but not for air temperature and arctic sea ice. Emergence is mentioned for Tropics temperature and sea level only. The relevance of A2 for policy-makers is not obvious. We suggest to delete A2 and to move some of the most relevant findings into other sub-sections (B, C, D). [Eric Brun, France]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.

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67637	6	5	6	5	should be "natural decadal and multi-decadal" [Karen Rosenlof, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
131673	6	5	6	6	Suggestion to reformulate this sentence as the message is not clear. As a suggestion: Human-induced climate change adds to climate variability? [Hans Poertner and WGII TSU, Germany]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
39525	6	5	6	6	Among the 1°C of temperature increase since the pre-industrial period, it is seen that about 0.6°C has been achieved between 1910 and 1945 (Fig. SPM4.B) in a period when the emissions were only 11 ppm. As a result, Ring, M.J., Lindner, D., Cross, E.F., Schlesinger, M.E., 2012 (Causes of the global warming observed since the 19th century. Atmos. Clim. Sci. 2, 401–415) consider that this increase was mainly natural. This was confirmed in IPCC FAR. As a result, only a part of +0.4°C since 1945 might be anthropogenic, in contradiction with the general tone of the SPM. [François Gervais, France]	Noted. The tone of this SPM reflects the outcomes from the compilation of all the assessments provided throughout the entire report showing evidence from multiple sources that human influence has warmed unequivocally the climate system. The respective weight between natural drivers versus anthropogenic drivers is assessed in details in Chap3. Both human and natural contributions are shown in Fig. SPM3a (new Fig. SPM1b) over the full period showing in particular their relative importance over 1910-1945. Those were assessed to be comparable over that period of time while the human influence overly dominates since the 1960s. It is wrong to estimate the human influence by taking simple differences between periods in observations which are potentially affected by internal variability. Proper attribution studies should be carried out to estimate the weight between the different factors and those are assessed in Chap3 and summarized in the SPM. Note also that human influence on climate includes GHG but also aerosols forcings and land use, which lead to opposite effects on temperature. Accounting only for CO2 ppm increase does not completely account for human influence. Again, only single-forcing attribution studies can tackle this issue.
81409	6	5	6	7	If this follows the previous pink box, it would be better to recast it by starting with the global and moving to the regional: e.g. "Human induced climate trends are more clearly seen on the global scale; at the regional level natural decadal or multi-decadal variability is more pronounced and relatively larger for water cycle etc. " [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
9475	6	5	6	7	This sentence is too long and should be clearer for this summary statement. Suggest rephrasing: Human-influenced climate trends are superimposed on natural decadal or multi-decadal climate variability, whose effects are more pronounced at regional scales than at the global scale. This variability is larger for most water cycle variables than it is for for temperature, which may dampen, mask or enhance the emergence of human forced trends in variables like precipitation. [Joelle Joelle Gergis, Australia]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.

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87315	6	5	6	7	too complicated language [Marcel Berk, Netherlands]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
23329	6	5	6	7	"Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability, whose effects are more pronounced at regional scales than at the global scale, and relatively larger for most water-cycle variables, including precipitation, than for temperature." This sentence is complex because it aims to transmit a lot of information, but perhaps it would be better to divide in several parts because it is difficult to follow the whole way through. I also think that the "relatively larger" part can be difficult to understand. Suggestion (that can be improved): "Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability. This variability is more pronounced on regional scales than on the global scale. The ratio between the climate trend and the natural variability is lower for most water-cycle variables, including precipitation, than for temperature." [Anna Amelia Sörensson, Argentina]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
86903	6	5	6	7	Sentence is difficult to understand., but message is important so please rephrase. [Oyvind Christophersen, Norway]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
16051	6	5	6	7	"Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability, whose effects are more pronounced at regional scales than at the global scale, and relatively larger for most water-cycle variables, including precipitation, than for temperature". It is not clear if "whose" applies to "human-induced climate trends" or "natural ...variability". I assume that "whose" refers to the natural variability, but this should be made clearer. [Daniel Lunt, United Kingdom (of Great Britain and Northern Ireland)]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
108989	6	5	6	7	Perhaps thiis first sentence can be better constructed and simplified/laymanized [Gemma Teresa Narisma, Philippines]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
50111	6	5	6	7	This opening sentence is perhaps overcomplicated by use of the word 'superimposed'. Is this context, is is it meant to mean that the human & natural trends are similar and therefore hard to discern from one another? Please clarify. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86901	6	5	6	12	Please consider to shorten this highlighted conclusion. In its current form we find it a little too detailed for policymakers, still the message you are trying to convey to policymakers is very important. The first sentence could in our view be reduced to read only "Human-induced climate trends are superimposed on internal and natural climate variability". In the second sentence, please include Arctic before "the tropics" in line 8 if appropriate, and also consider to replace "discernible" with either "distinguishable", "identifiable" or "detectable", or one alternative formulation for the end of the second sentence could be "... decline in Arctic sea ice are already clearly attributable to human-induced climate change.". In the third sentence, please consider to include "and risks" after "emergence", and consider to either replace "internal" with "natural" or add "and natural" after "internal", if appropriate. Please consider to slightly reformulate and preferably shorten this highlighted conclusion. [Oyvind Christophersen, Norway]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
76927	6	5	6	12	Perhaps reduce the detail in the statement. What is the message for policy? [Emer Griffin, Ireland]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
76929	6	5	6	12	Avoid terms like internal variability, natural variability was used earlier. [Emer Griffin, Ireland]	Noted in the revised structure of the SPM.
76931	6	5	6	12	What are water cycle variables? [Emer Griffin, Ireland]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
130435	6	5	6	12	The headline statement for "Relatively larger for most water-cycle variablesthan for temperatue" should be very cautious! [Panmao Zhai, China]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM.
112775	6	5	6	12	This key finding is really important, but currently very hard to read for non-specialists. For a summary statement in the SPM I would try to rewrite to make it simpler and easier to understand, even if this requires more words [Maarten van Aalst, Netherlands]	Taken into account. A2, as a stand-alone subsection, has been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
108179	6	5	6	12	The descriptions in these red boxes are effective at clearly laying out the issue in some cases, and not so effective in others. The explanation in this case veers more toward the technical side, and may be difficult for policymakers to consume. This comment holds for much of the rest of the content in A.2. A much more plain language approach needs to be taken to address this topic effectively here. [Anton Holland, Canada]	Taken into account. Headline statement (red box) and A2, as a stand-alone subsection, have been removed and related contents have been disseminated across the newly structured SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.

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5271	6	5	6	12	This red box comes across as weaker than the other red boxes (see my comments on the next two). For one thing, the first sentence is very, very long. For another, I don't think it picks out the most important conclusions from the bullet points. I suggest "There has been much discussion about observed warming from 1998 to 2012, termed by some the "hiatus". This period is now much better understood in the context of solar and volcanic forcing and natural variability, which can temporarily either enhance or damp human-induced change. It is virtually certain that ocean heat content continued to increase throughout this period and the slowdown was only evident in the atmosphere and surface temperature. Since 2012, GMST has warmed strongly, with the past five years (2014-2018) being the hottest five- year period in the instrumental record until 2018." [Daniel Murphy, United States of America]	Taken into account. Headline statement (red box) and A2, as a stand-alone subsection, have been removed and related contents have been disseminated through the newly structure SPM. In addition, the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. Regarding the "hiatus" period, a specific statement (new HS10.1) is devoted to this issue in the 3rd section (Climate Information for Risk Assessment and Regional Adaptation) in which natural variability, including internal variability, is presented as a modulator of human-caused changes and as an important factor to consider for risk assessment and planning.
53455	6	5	6	12	Complete the last sentence with: "and some regions will experience earlier and stronger near-term changes than others due to an aggravating contribution from internal variability."? [Hervé Douville, France]	No applicable anymore because the headline statement (red box) and section A2 have been removed from the revised , have been removed from the revised SPM. The important information it contained has been incorporated in the newly structured SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM.
129749	6	5	6	12	[PROGRESS] The pink box summary statement for Section A.2 (from global to regional scales) again understates the AR6 findings regarding anthropogenic warming. This could lead policymakers to underestimate the magnitude of the problem, and to attribute more climate phenomena to natural regional, decadal, and multi-decadal phenomena than is warranted by the data. Based on the information provided in paragraphs A.2.1 -A.2.6, the summary statement could be strengthened as follows (suggested additional language IN CAPITALS, suggested deletions in [brackets]): "Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability, whose effects are more pronounced at regional scales than at the global scale, and relatively larger for most water-cycle variables, including precipitation, than for temperature. SINCE AR5, ENHANCED CAPACITY TO DISTINGUISH INTERNAL VARIABILITY FROM FORCED CHANGE HAS CONFIRMED SUBSTANTIAL HUMAN-INDUCED INCREASES IN GLOBAL [The increase in] surface AIR temperature, GLOBAL OCEAN HEAT CONTENT, AND SEA LEVEL, [over land, especially in the tropics,] and [the] A RAPID decline in Arctic sea ice. [are already clearly discernible from natural variations]. In terms of future emergence, the relative strength of internal variability and human-induced trends will depend on the region, the variable, and the level of global warming (high confidence)." [Trigg Talley, United States of America]	Taken into account. To avoid that "policymakers to underestimate the magnitude of the problem", "Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability" have been rephrased as "Natural drivers and internal variability will modulate human-caused changes", now placed in the 3rd section (Climate Information for Risk Assessment and Regional Adaptation) , after the 1st section, which clearly stated the role of human influence on the climate trends.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65501	6	5	6	12	Suggest clarification of this sentence. Suggest changing it to "Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability. The relative effects of variability are more pronounced at regional scales than at the global scale, and are larger for most water-cycle variables, including precipitation, than for temperature." [Kushla Munro, Australia]	Taken into account. "Human-induced climate trends are superimposed on natural decadal or multi-decadal climate variability" have been rephrased as "Natural drivers and internal variability will modulate human-caused changes" and is now the headline of Section C.1 (in the final, approved SPM), a section that highlights both the regional-scale and the difference between temperature and precipitation suggested by the reviewer.
129747	6	5	6	50	It is not correct to say that the human component is "superimposed ..." for precipitation-related variables, where nonlinearity comes strongly into play. For instance, in A.2.5, the result should be conditional, such as it rains harder when it rains. In A.2.2, internal variability is also underestimated in observational analyses, conditional on the available observed record including hiatus period. These statements should be corrected by making them conditional. [Trigg Talley, United States of America]	Taken into account ("superimposed"). In the final (approved) SPM C.1 now phrases this as "Natural drivers and internal variability will modulate human-caused changes". A.2.5 has been reformulated, see C.1.3, A.2.2 not applicable, has been removed for SPM.
78255	6	5	7	7	It is stated that effects are more pronounced at regional scales than at global scales, but there is no elaboration. It would be useful to state which regions face the highest risks. [Leonie Lee, Singapore]	Taken into account. Headline statement (red box) and A2, as a stand-alone subsection, have been removed and related contents have been disseminated through the newly structure SPM. There is now a dedicated section (3rd section -HS10-11) on assessments of climate information that are important to consider for risk assessment and are regional scale for adaptation. The role of internal variability in modulating human-caused changes is tackled there with a focus on regional changes. Note also that the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
78257	6	5	7	7	It would be useful to include some headline numbers on global mean surface temperature (GMST) warming trends and sea level rise. [Leonie Lee, Singapore]	Rejected. Headline statement (red box) and A2, as a stand-alone subsection, have been removed and related contents have been disseminated across the newly structured SPM. But note also that the narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36033	6	5			This statement is difficult to understand and combines too many ideas at one. Here is a quick attempt: Human-induced climate trends are superimposed on natural climate variability that occurs over decades or longer. Natural variability is more pronounced at regional than at global scales; and it is relatively larger for most water-cycle variables, including precipitation, than for temperature. [Is this really true when we look at human driven desertification, aerosol-precip, etc??] The observed increase in surface temperature[s] over land, especially in the tropics, and the decline in Arctic sea ice are clearly larger than natural variations. In terms of the future, the emergence of human-induced trends above natural variability will depend on the region, the climate variable, and the level of global warming (high confidence). [Michael PRATHER, United States of America]	Noted. Headline statements are now much simpler and shorter to provide a high level summary of the SPM. The red box and A2 as a stand-alone subsection, have been removed and related contents have been disseminated across the newly structured SPM.
65025	6	6	6	6	Who could have the idea that variability could be larger at global than at regional level? This half-sentence is meaningless. [Johannes Quaas, Germany]	Rejected. We consider that this information is relevant for policymakers, because it is at regional scales that adaptation action is taken. See introduction of section C that put this half-sentence into context.
67641	6	6	6	6	"whose effects" should be "its effects" and also note, this is a serious run on sentence. Rewording is [Karen Rosenlof, United States of America]	Not applicable. Sentence has been substantially revised.
45209	6	6	6	6	"whose effects are more pronounced". Does "whose" refer to human-induced climate trends or "natural climate variability"? Clarity of this sentence could be improved. [Krishnan Raghavan, India]	Not applicable. Sentence has been substantially revised.
101517	6	6	6	7	Change "whose effects are more pronounced at regional scales than at the global scale, and relatively larger for most water-cycle variables," to "the effects of which are more pronounced at regional scales than at the global scale, and are relatively larger for most water-cycle variables," [Knut Nadelhoffer, United States of America]	Not applicable. Sentence has been substantially revised.
129751	6	6			Change "whose effects are more pronounced..." to "the latter effects being more pronounced..." [Trigg Talley, United States of America]	Not applicable. Sentence has been substantially revised.
27713	6	7	6	7	It is not clear why a specific focus on the water cycle only is given here. [Eric Brun, France]	Not applicable. The sentence has been deleted.
97197	6	7	6	7	A distinction is made between "water-cycle variables" and "temperature". As air temperature is one of the main drivers of evaporation, it is often also regarded as a "water-cycle variable". Please clarify if precipitation or any other individual variable is meant here instead of summing up all "water variables". [Nicole Wilke, Germany]	Taken into account. In the FGD we have avoided the mentioning in this general sense of "water-cycle variables" in the section on interplay between natural variability and human-induced trends, which is now C.1.
69297	6	7	6	7	The description, "larger for most water-cycle variables, including precipitation, than for temperature" might be misunderstood to underestimate the extreme event on high temperature (heat waves). It would seem preferable that both precipitation and temperature be described and treated equally. [Kaoru Magosaki, Japan]	Taken into account. The FGD does not compare temperature and precipitation in this way, but treats them in different paragraphs. See Section HS10.
129753	6	7	6	7	The latter part of the first sentence in A.2 red box gets lost in meaning because it is so long. Recommend to create a new sentence discussing water-cycle variables and their relative change to temperature for clearer understanding. [Trigg Talley, United States of America]	Taken into account. Text has been totally rewritten in shorter and more concise sentences.
40571	6	7	6	9	No uncertainty language -- so statement of fact? NB in the TS it states: "Anthropogenic influence has been identified as the very likely dominant cause for the observed reductions of Northern Hemisphere spring snow cover, global glacier mass, and Arctic sea ice." so "very likely at least for the NH. [TSU WGI, France]	Not applicable. Sentence has been substantially revised.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32347	6	7			What is meant by "relatively larger"? This should be made better understandable. Does it refer to changes relative to the absolute values of precipitation and temperature or to their variability? I am also not sure if it really makes sense to compare precipitation and temperature in this way. What is the information content of this statement? [Clemens Schwingshackl, Norway]	Taken into account. The FGD does not compare temperature and precipitation in this way, but treats them in different paragraphs. See Section HS10.
65027	6	8	6	8	It is difficult to understand the “especially in the Tropics”. Either it is discernible from natural variability only in the tropics, or also elsewhere. In the former case, the “especially” has to be omitted, in the latter case, the larger region needs to be named. [Johannes Quaas, Germany]	Not applicable. The sentence has been deleted.
107967	6	8	6	11	this section title covers global to regional scales, but some wording here is ambiguous about which scale is being considered. At the global scale, warming over the oceans has already "emerged", whereas this just talks about land warming implying that ocean warming hasn't emerged. The meaning of the sentence beginning "In terms of future emergence" is unclear to me. Do you mean that internal variability and human-induced trends are both dependent on region, variable and level of global warming and these in turn affect future emergence of the human-induced signal? Perhaps also change "internal" to "natural" to match the first sentence of this headline statement? [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The introduction to the Section C of the final SPM states that we refer to "climate information at global, regional and local scales", and in the section text the spatial scale of each statement is specified. The section does not use the concept "emergence", and we now refer to "natural drivers and internal variability" to avoid confusion.
80071	6	8	6	11	Before the surface temperature (8th line) the time-scale is missing, is it annual? It is important to include it. We do not recommend emphasizing the tropics here (8th line) as it suggest without being in the context that it observed the largest warming, which is not the case. Also, mixed wording takes place here: natural variations (9th line), it should be coherently natural variability. Furthermore, emergence depends on the emission scenario and the season too. Please place these too at the end of the paragraph (11th line). [Lilian Fejes, Hungary]	Taken into account. The whole section has been rewritten and all these observations have been considered. The tropics is no longer emphasized, the language has been streamlined and we use "natural drivers" and "internal variability". Emergence is no longer used in this section.
104023	6	9	6	9	If "clearly discernible" means that it has clearly "emerged" (in the sense of Box SPM.1), then it may be preferable to use the latter term for consistency. If it means something different, then it would benefit from some clarification. [Philippe Tulkens, Belgium]	Not applicable. We do no longer use the concept of emergence in this section.
65029	6	9	6	11	This statement is trivial. The confidence statement is meaningless. Instead, selected tangible results should be reported. [Johannes Quaas, Germany]	Not applicable. The sentence has been deleted.
87317	6	9	6	11	The last sentence is unclear [Marcel Berk, Netherlands]	Not applicable. The sentence has been deleted.
27715	6	9	6	11	In the interest of keeping this box short, we suggest to remove this sentence which is not very informative, and replace it with the last sentence of A.2.3 "Since 2012, GMST has warmed strongly, with the past 5 years being the hottest 5-year period in the instrumental record until 2018". If so, the sentence in the paragraph should be deleted (page 6, lines 34-35). [Eric Brun, France]	Not applicable. The sentence has been deleted and the introduction totally re written.
20329	6	9	6	12	How could anybody disagree with this statement? However, adding a "high confidence" stamp on it may have a weakening effect rather than a strengthening one. Was the uncertainty language, as commented upon in Box.1, and based on Mastandrea et al. (2010), elaborated in view of the present kind of statement? This question, which comes again and again, will be developed in comments concerning the entire report. [philippe waldteufel, France]	Taken into account. The sentence has been replaced by statements that carries more information. See C1. in the final, approved SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
40831	6	9	6	12	SPM <-> TS: This comment relates to finding support for a particular SPM headline statement in the TS: Where is the support in the TS for this SPM headline statement : " In terms of future emergence, the relative strength of internal variability and human-induced trends will depend on the region, the variable, and the level of global warming (high confidence)." ? [TSU WGI, France]	Not applicable. The sentence has been deleted.
38887	6	9	6	12	Native speakers might be able to guess what "future emergence" means, but in general I think this is scientific language that might not be understood by all readers of the SPM. Suggestion to rephrase: "For other variables, the region, the level of global warming and the variable itself will determine the relative strength of internal variability and the human-induced trends and, as a consequence, the moment when human influence becomes obvious." [Maike Nicolai, Germany]	Not applicable. We do no longer use the concept of emergence in this section.
36035	6	9			"discernible from" seems to invoke statistical test and minutiae, that is hardly of interest at this level, what is clear is that they are larger! If the trend is 1% of the year-to-year, but discernible, then this is not a headline. [Michael PRATHER, United States of America]	Not applicable. The sentence has been deleted.
53453	6	9			replace "emergence" by "emergence and impacts"? [Hervé Douville, France]	Not applicable, this part of the SPM has been completely rewritten.
129755	6	9			Change "are already clearly discernible from natural variations..." to "are regional examples of changes clearly distinguishable from natural variations..." [Trigg Talley, United States of America]	Not applicable. The sentence has been deleted.
111093	6	9			in terms of future emergence' unhelpful I think its clear without it! [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. We do no longer use the concept of emergence in this section.
36037	6	10			"strength" again seems odd here. "internal variability" is introduced here without context, I think you mean natural variability (internal & forced by volcanoes & sun) [Michael PRATHER, United States of America]	Not applicable. The sentence has been deleted.
129757	6	10			Change "internal variability" to "natural variability" [Trigg Talley, United States of America]	Taken into account. We now use "natural drivers" and "internal variability" to avoid confusion.
64785	6	15	6	15	The difference between dampening and masking human-induced trends is unclear (in this section). If those terms are not defined then I recommend one negative term to accompany the positive “enhance.” As “dampening” is used in line 17 but masking does not seem to be used, recommend striking mask. [Casey Kopcho, United States of America]	Taken into account. In the revised statement (HS10), special attention has been devoted to the wording used to describe the modulation of the human-caused changes by internal variability in order to be the most consistent possible across the entire SPM
12637	6	15	6	16	What about energy budget? [Lijing Cheng, China]	Not applicable. Energy budget is assessed in HS.4
25733	6	15	6	16	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
81883	6	15	6	16	The lines comment that variability in variables relating to the water cycle have a large influence on human-induced trends. Some examples of variables related to the water cycle would be useful for policymakers [Dan Zwartz, New Zealand]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129761	6	15	6	16	Human-induced trends can also dampen, mask, or enhance natural variability? Seems like the opposite of this statement is also quite true, and the knowledge exists to assess the extent to which that enhanced, dampened, or masked natural variability is due to humans. A statement should be added to address the influence of human-induced changes on natural variability. [Trigg Talley, United States of America]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
81819	6	15	6	17	Use of the technical term "dampen" when it is the water cycle that is under discussion might cause confusion. Consider alternative wording? (also in line 17) [Dan Zwartz, New Zealand]	Taken into account. In the revised statement (HS10), special attention has been devoted to the wording used to describe the modulation of the human-caused changes by internal variability and in order to be the most consistent possible across the entire SPM
65503	6	15	6	18	Suggest clarification of this text. Suggest changing it to "Natural variability may dampen, mask or enhance multi-decadal human-induced trends..." also change text to "There is very high confidence that periods of both damping and enhancement of underlying human-forced trends will continue..." Suggest this change since we don't know yet to what extent this dampening, masking or enhancement may be temporary or not. [Kushla Munro, Australia]	Taken into account. In the revised statement (HS10), special attention has been devoted to the wording used to describe the modulation of the human-caused changes by internal variability and in order to be the most consistent possible across the entire SPM
65031	6	15	6	19	If I was a policymaker, I would not understand any message here. Also as a scientist, the only not completely trivial statement is that variability for the water cycle is particularly important. But even there, it is not clear what the "larger" refers to. Larger than for the carbon cycle? [Johannes Quaas, Germany]	Noted. The entire statement A2.1 has been rewritten with 3 new more focussed HS statements (H10) in the revised version: HS10.1 specifically on decadal variability, HS10.3 specifically on temperature and near-term and HS10.4 on precipitation.
42009	6	15	6	19	Isn't "changes" a general, more suitable word for describing human-induced impacts on climate indicators on multidecadal time scales than "trends". "Trends" are often understood as linear trends. [Juhani Damski, Finland]	Taken into account. In the revised statement (HS10), special attention has been devoted to this wording and in order to be the most accurate possible when referring either to trends or changes.
37227	6	15	6	19	This is a remarkably banal paragraph but one that dishonestly that says "can" (third word) when the correct and honest note would say that natural influences DO influence data trends. [John McLean, Australia]	Taken into account. "Can" has been replaced by "do" and "will continue to occur" in the revised statements now in HS10.1. The latter is also more precise (focus on the latest observed slow down period) to make it less "banal".
76933	6	15	6	19	The terms used are highly technical, other terms can explain what is meant more clearly, e.g. enhance, reduce. [Emer Griffin, Ireland]	Taken into account. In the revised statement (HS10), special attention has been devoted to the wording used to describe the modulation of the human-caused changes by internal variability and in order to be the most consistent possible across the entire SPM
76935	6	15	6	19	The message seems to be that natural variability will continue and may either amplify or reduce the observed changes due to climate change. If this is the case then a simple statement can be used. [Emer Griffin, Ireland]	Accepted. The new HS10.1 statement has been rewritten accordingly to make it more simple
76937	6	15	6	19	Use either natural variability or internal but not both. Also using the term forced here is fine for scientists but is otherwise it is technical and obscure jargon. [Emer Griffin, Ireland]	Accepted. The new HS10.1 statement has been rewritten accordingly to make it more simple and more accurate. Human-forced has been replaced by human-caused to be also consistent across the entire SPM. Distinction has been made between internal variability and natural factors.
12635	6	15	6	25	A2.2 should go before A2.1 [Lijing Cheng, China]	Not applicable. The new structure of the revised SPM has incorporated the information very differently.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
5273	6	15	6	36	I was really puzzled when I first read these three bullets. They sounded so weak and academic. Then I realized that they were talking about what has been termed the “hiatus”. I strongly suggest taking it straight on and saying something like “A.2.1 There has been much discussion about observed warming from 1998 to 2012, termed by some the “hiatus”. This period is now much better understood in the context of observations. A reduced rate of warming is now better understood in the context of solar and volcanic forcing and natural variability, which can temporarily either enhance or damp human-induced change.”. Then A 2.2 and A.2.3, except delete “Subsequent analyses...winters” from A2.3. The latter distracts from the focus of A.2.3 on observations. [Daniel Murphy, United States of America]	Not applicable. The SPM was significantly reorganised. Section A has been removed and the important information it contained has been incorporated in the other sections.
101519	6	15			Change "either dampen, mask or enhance" to "either dampen, mask, or enhance" [Knut Nadelhoffer, United States of America]	Not applicable. Statement rewritten (new HS10)
36039	6	15			You cannot say "temporarily" because it assumes a future (another section, scenarios also). Drop "either" also, makes harder to read. [Michael PRATHER, United States of America]	Not applicable. Statement rewritten (new HS10)
129759	6	15			Change "dampen, mask, or enhance..." to "add to or subtract from..." [Trigg Talley, United States of America]	Not applicable. Statement rewritten (new HS10)
69299	6	16	6	18	It is ambiguous whether this sentence comes from the results of model calculation or actual (observed) data. To avoid misleading readers by clarifying the source of data, whether they are the result of model calculation or actual (observed) data should be clarified. [Kaoru Magsaki, Japan]	Noted. In the revised version of HS10 statement, "projected" is consistently used when referring to models. And in the final (approved) version, the word historical has been added to specifically refer to observations (in C.1).
129763	6	16	6	18	Rewrite the sentence beginning "There is very high confidence..." to read "Temporary periods of additive or diminutive contributions to underlying human-forced trends are certain to occur in the 21st century." [Trigg Talley, United States of America]	Noted. Sentence rewritten but level of confidence not changed to be traceable to Chapter's assessment. Very high confidence level is given and not a statement of fact (certain) because there is a non-zero probability (also weak as assessed from models) that depending on warming level, decadal internal variability may change structure and variance.
32349	6	16			Maybe change to "at regional scales compared to global estimates" [Clemens Schwingshackl, Norway]	Noted but statement rewritten (new HS10)
25735	6	17	6	17	"Damping" should be replaced by "dampening" [Don Alfonso Pino Maeso, Spain]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
129765	6	17	6	17	It might be useful to provide an example for dampen and enhance. [Trigg Talley, United States of America]	Accepted. The latest warming slowdown observed over 1998-2012 is now mentioned in the revised statement (HS10)
5275	6	17	6	18	The sentence “There is very high confidence that temporary periods of both damping and enhancement of underlying human-forced trends will continue to occur on decadal timescales in the 21st century” is a good one but duplicates C.3.5 “Internal variability will continue to exert a substantial influence on climate.” [Daniel Murphy, United States of America]	Accepted. Sentence rewritten accordingly in HS10.1
36041	6	17			"temporary" seems wrong, how about 'brief' or decadal' ? [Michael PRATHER, United States of America]	Accepted: replaced by "one of two decades"
69301	6	18	6	18	Chap.1 P49L3-P49L28 discusses the case on smaller spatial AND temporal scale. "On smaller spatial and temporal scale" might convey a more precise message than "on decadal timescales" in the SPM. [Kaoru Magsaki, Japan]	Noted. The statement has been rewritten accordingly to account for the idea of the comment. The specific "regional signature" of the internal variability modes is now specifically mentioned and the temporal scale is specified ("one or two decades").

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86071	6	21	6	21	"quantification of" – Recommend using active voice and direct verbs (as opposed to verb-nouns) throughout, for improved readability, i.e. "quantifying" [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
38889	6	21	6	21	Does "forced change" refer to human influences? If yes, I would say so ("human-induced"). [Maike Nicolai, Germany]	Noted. Not necessarily, forced change can also be natural external variability that can result from changes in the Earth's orbit, small variations in energy received from the sun, or from major volcanic eruptions.
27717	6	21	6	23	The second part of the sentence (starting with "based on...") is not essential in a SPM. We suggest to delete it in order to shorten the SPM. [Eric Brun, France]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy makers.
25737	6	21	6	23	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
87895	6	21	6	25	The meaning of this paragraph is unclear and written for people with technical insight, not for policy makers. This should not be one of the first things that policy makers read. You will lose them right here. [John Carstensen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy makers.
37229	6	21	6	25	This paragraph is merely an assertion unless you can prove those simulations to be accurate (in which case can't there only be one accurate simulation at most?) [John McLean, Australia]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
42189	6	21	6	25	A2.2: Good, but technical. Could this be a TS comment instead? [Tina Christensen, Denmark]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36043	6	21			keep parallel structure "quantifying" BTW maybe you need to explain earlier or in the box above about nature/human, forced/internal since you start using forced here. [Michael PRATHER, United States of America]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
129767	6	21			Change "internal" to "natural" [Trigg Talley, United States of America]	Rejected. Internal variability here refers to natural internal (or spontaneous) variability, as opposed to natural external variability.
129769	6	22	6	22	End the sentence at "...since AR5, especially at regional scales." to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25819	6	23	6	23	It would be useful to include the definition of "historical period" the first time it is used. According to chapter 3, page 47, line15 it is 1850-2014 but according to chapter, 3 page 54, line 31 it is 1860-2014. Moreover, footnote 3 of page 3 of the SPM only indicates that: "The historical period in CMIP6 simulations ends in 2014" [Don Alfonso Pino Maeso, Spain]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
86073	6	24	6	24	"role of internal variability has been underestimated in projections in some regions" – explain the implication of this. E.g. drought or flooding or heat waves are actually worse locally than the coarse models predict. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
27719	6	24	6	24	The list of these regions or at least a few examples would be useful. [Eric Brun, France]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
8077	6	24	6	24	Clarify which regions, and on which timescales. For temperature, hydrology or both? Due to what? [Frank Dentener, Italy]	Not applicable. Bullet point removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50101	6	24	6	24	A2.3 refers to GMST, whereas the rest of the SPM focusses on GSAT - the choice of which is used throughout the SPM should be kept consistent where possible to avoid confusion. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
54591	6	24	6	25	The last sentence in this paragraph is unclear. Is the intended message that projections of regional climate trends may be either too high or too low (or insufficiently variable) because internal climate variability is not sufficiently well modeled in past generation of models? Is this true for the late century projections as well? Perhaps alternate wording to consider would be "it is likely that some projected regional climate trends in past assessments have underestimated contributions from internal climate variability". Alternative or additional text to consider, with perhaps a more important message for policymakers, is the following from Ch. 10-63 lines 16-19 "There is high confidence that internal variability introduces substantial irreducible uncertainty in regional climate change attribution and projections, on time scales from a decade to a century." [Nancy Hamzawi, Canada]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
54593	6	24	6	25	This is an example of a broader issue that arises in multiple places in the report and must be addressed. The assessment statement is that it is 'likely' (meaning >66% probability) that internal variability has been underestimated in "some regions in previous assessments". It is not at all clear in the underlying text how this likelihood estimate was arrived at. Was it only 'likely' in some regions? If the degree of underestimation is different in different regions, how was the overall assessment of >66% probability computed? The underlying text in 10.3.4.3 seems to use a confidence statement rather than a likelihood statement. The basis for, and traceability of, all calibrated statements in the SPM should be carefully checked by the authors. [Nancy Hamzawi, Canada]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
31577	6	24	6	25	This sentence is vague and unclear. It would be great if made more specific and clear and the exact meaning. [Jean-Baptiste SALLEE, France]	Not applicable. Bullet point removed from revised SPM.
104025	6	24	6	25	The latest sentence should be complemented. Is this underestimation in some regions a general trend? Is there also some overestimation in other regions? The consequences of the underestimation/overestimation of internal variability in projection in some regions should be briefly explained. Besides, a sentence should give the situation for forced change: has the forced change been also underestimated/overestimated in some regions? [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed from revised SPM.
90735	6	24	6	25	Ambiguous sentence: should we understand that the natural regional variability has been underestimated in models and therefore that changes in regional climate are not due to anthropogenic action? Please, write a less ambiguous sentence. [José Romero, Switzerland]	Not applicable. Bullet point removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
101521	6	24	6	25	Change "has been underestimated in projections in some regions in previous assessments." to "has been underestimated in projections in previous assessments for some regions." [Knut Nadelhoffer, United States of America]	Not applicable. Bullet point removed from revised SPM.
42395	6	24	6	25	Statement begs the question: where and how? [Tina Christensen, Denmark]	Not applicable. Bullet point removed from revised SPM.
44705	6	24	6	25	This sentence is unclear (which regions?, why is this important?). Suggest replacing with a statement on where improvement is seen. [Markku Rummukainen, Sweden]	Not applicable. Bullet point removed from revised SPM.
50109	6	24	6	25	The final sentence of A2.2 reads a little bit like an attribution statement and could unwittingly mislead the reader into thinking that as a result of this underestimation, anthropogenic climate change will have less of an effect than previously thought at a regional level. The relevant section (10.3.4) is more of an assessment of the role that internal variability plays in the uncertainty of regional projections - it's related but not quite the same thing. Could this sentence be amended to better reflect the underlying text in Chapter 10? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed from revised SPM.
107973	6	24	6	25	The statement about internal variability will likely be misunderstood as implying that internal variability has previously been underestimated. Section 10.3.4 and papers cited there does not support such a claim. Instead the new large ensembles allow a better separation of multi-model ensemble spread into internal variability and model error terms, which is different to the suggestion that they previously underestimated internal variability. I know the wording is underestimated "the role" of internal variability, but this will easily be misunderstood as implying that internal variability itself had been underestimated -- there's no evidence it had. Instead this should be a positive message about our new, better understanding of the contributions to ensemble spread. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed from revised SPM.
111095	6	24		25	this is a surprising statement - what aspect of variability has been underestimated? Or is it larger now? Why would it have been underestimated the models appeared to have had similar variability in the past (with some encompassing the observations some not?) [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed from revised SPM.
129771	6	24			Change "internal" to "natural" [Trigg Talley, United States of America]	Not applicable. Bullet point removed from revised SPM.
27721	6	25	6	25	Should read "10.3.4.3". [Eric Brun, France]	Not applicable. Bullet point removed from revised SPM.
29389	6	25	6	25	which regions? [Joachim Fallmann, Germany]	Not applicable. Bullet point removed from revised SPM.
110731	6	25	6	28	This statement may not cover the full range of studies mentioned in Table 9.2. This is also valid for the upper right panel in Fig. 9.20. [Torsten Albrecht, Germany]	Taken into account. Sentence has been reformulated.
50097	6	27	5	36	The first sentence in A2.3 could be made clearer. Suggested rephrasing: 'Estimates of the observed warming in the 1998-2012 period are higher than previous assessments in AR5, as a result of updated observational products' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. It has been decided not to mention previous AR5 assessment in this bullet.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50099	6	27	5	36	A2.3 could be clearer that the anthropogenic contribution to global warming did not slow down in the 1998-2012 period by saying, for example ""Subsequent analyses have confirmed that the observed reduced rate of warming relative to earlier decades was not due to a reduced rate of anthropogenic warming, but this warming being marked by the combined influence of cooling from solar and volcanic forcing and internal variability..." [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Statement completely rewritten
87319	6	27	6	27	unclear what observational products are; sentence unclear [Marcel Berk, Netherlands]	Not applicable. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
104027	6	27	6	27	Recommend to explicitly mention the word 'hiatus' as many will recall it like this. The hiatus was in reality only variability in a part of the climate system. Why GMST instead of GSAT? [Philippe Tulkens, Belgium]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
8079	6	27	6	27	Recommend to explicitly mention the word 'hiatus' as many will recall it like this. The hiatus was in reality only variability in a part of the climate system. Why GMST instead of GSAT? [Frank Dentener, Italy]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
97199	6	27	6	27	There should be a hint here that the period 1998-2012 was referred to as global warming hiatus/pause. [Nicole Wilke, Germany]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
110775	6	27	6	27	I wonder how useful is this first line [cathy clerbaux, France]	Taken into account. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
6351	6	27	6	27	"consistently larger in updated observational products" should be changed to "larger in several updated observational products". The estimate of 1998-2012 warming from the (observationally-based) ERA5 reanalysis is the same as that from the ERA-Interim reanalysis, to the second decimal point (in terms of degC/decade rate of temperature increase), provided ERA-Interim is adjusted for a known discontinuity in SST analysis. ERA5 is the replacement product for ERA-Interim. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
15389	6	27	6	28	Executive Summary of Chapter 3 writes: "Using updated observational data sets and like-for-like comparison of simulated and observed merged near-surface air temperature and sea surface temperatures, all observed estimates of the 1998-2012 trend in GMST lie within the 5-95% range of CMIP6 trends." (page 4, line 46). In this connection, improved understanding of the different definitions used in the simulation and observation, GSAT and GMST, would be worth of being noted in SPM. [Junichi Tsutsui, Japan]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54595	6	27	6	28	We doubt that Policy-makers will know the significance of the time period 1998-2012. Suggest identifying it as a "warming hiatus". [Nancy Hamzawi, Canada]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
76939	6	27	6	28	How important is this for policy makers to know? [Emer Griffin, Ireland]	Noted. We believe that the full range of climate outcomes is essential to consider for risk assessment and planning. The role of internal variability in such a context is now clearer in the new SPM structure and the introduction to the 3rd section on Climate Information for Risk Assessment and Regional Adaptation
97201	6	27	6	28	With this formulation it is insinuated that the updated observed temperatures time series changed in the time period 1998 -2012 by considering solar and volcanic forcing. But the effect of forcing is already in the observations? The updated time series could change however by better accounting for instrumental biases and a better method filling gaps. That was stated in the SROCC Ch5 page 15. [Nicole Wilke, Germany]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
35257	6	27	6	28	Indeed there is now more warming in the 1998-2012 record because the revised SST adjusts up all the buoy data by .12degC to match the very suspect shipboard intake tube temperatures. Because there are more and more buoys deployed in this period, that GUARANTEES a slightly increased warming trend. [patrick Michaels, United States of America]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
34509	6	27	6	28	The first sentence in A2.3 could be more specific: biases in the historical sea surface temperature record significantly contributed to the appearance of a reduced rate of warming from 1998-2012. There are a number of papers addressing this point, such as: Karl, T.R., A. Arguez, B. Huang, J.H. Lawrimore, J. McMahon, M.J. Menne, T.C. Peterson, R.S. Vose, and H.M. Zhang. 2015. Possible artifacts of data biases in the recent global surface warming hiatus. Science 348:1469-1472, doi:10.1126/science.aaa5632. [Russell Vose, United States of America]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
14551	6	27	6	29	First sentence says "Observed warming in the 1998-2012 period is consistently larger..". Second sentence says "...confirmed that the observed reduced rate of warming relative to earlier decades.." This sounds conflicting. Modify second sentence to read something like " the lower rates of warming reported in AR5 is due to...." [Roshanka Ranasinghe, Netherlands]	Taken into account. First sentence removed in the revised version HS10.1. Statement completely rewritten and it was decided not to refer anymore to AR5 in this statement
129773	6	27	6	30	This is confusing. First it says the observed warming is larger; then it says the observed reduced rate of warming relative to earlier decades. A reduced rate of warming integrated over time will give a reduced magnitude of total warming. [Trigg Talley, United States of America]	Taken into account. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. Statement completely rewritten.
78259	6	27	6	31	Suggest to state what is the observed warming is relative to [Leonie Lee, Singapore]	Not applicable anymore as rephrased.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131675	6	27	6	32	This first sentence fits better in A1 where the evolving evidence base is assessed [Hans Poertner and WGII TSU, Germany]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
86059	6	27	6	35	"larger" warming but "reduced rate" seems to contradict each other. The meaning or importance of the second sentence is not clear. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable anymore. First sentence removed in the revised version HS10.1. Second sentence reformulated.
76941	6	27	6	35	The added value of this section is not clear? What is the message for current policy? [Emer Griffin, Ireland]	Noted. We believe that the full range of climate outcomes is essential to consider for risk assessment and planning. The role of internal variability in such a context is now clearer in the new SPM structure and the introduction to the 3rd section on Climate Information for Risk Assessment and Regional Adaptation
76943	6	27	6	35	Not clear why temperature data are linked with sea-ice changes here? These are important but differ perhaps addressed in separate sections. [Emer Griffin, Ireland]	Taken into account. To avoid confusion, sea ice is no longer mentioned in HS10, which covers natural variability.
76945	6	27	6	35	"unresolved small-scale processes hamper strong quantitative model consensus" does not have relevance for policy. [Emer Griffin, Ireland]	Taken into account. Sentence no longer features in the revised SPM.
9713	6	27	6	35	A.2.3 seems to be a decisive knock-down of the so-called hiatus or pause. If that's the case should it be spelled out even more clearly using those words? [Jonathan Lynn, Switzerland]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
42011	6	27	6	36	It is not clear to reader why this bullet is in A2. Connection to A.2.1 and A2.2 is unclear with the first sentence. Deleting or postponing the first sentence could help understanding. [Juhani Damski, Finland]	Accepted. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
23331	6	27	6	36	The regional attribution case study "10.4.1.2.5 The central and eastern Eurasian winter cooling" concludes that "there is high confidence (robust evidence and medium agreement) that a significant (at least 50%) fraction of the recent Eurasian cooling has been caused by internal atmospheric variability associated with a weakening of the polar vortex" (Ch10, p84, I30-32). Please consider if this assessment could contribute to this paragraph. [Anna Amelia Sörensson, Argentina]	Noted. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements. That said, the intrinsic "regional signature" of the internal variability modes is still mentioned in the revised version but without specific examples for simplicity.
111435	6	27	6	36	Is it necessary to reference the "hiatus" period here? It seems a left-over now and not very relevant to policy makers or the public. However, if this paragraph remains, should it be prefaced with the words "hiatus period" or similar to give context? [James Renwick, New Zealand]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104029	6	27	6	36	Before entering in some particularities of some time period, the SPM should introduce key policy-relevant figures of current climate change: what is the current level of global warming? Of sea rising? Etc. [Philippe Tulkens, Belgium]	Noted. The new version of the SPM is organized accordingly with current climate change presented first and modulation of the changes by internal variability mostly assessed in Section C (Climate Information for Risk Assessment and Regional Adaptation).
31583	6	27	6	36	This paragraph would benefit from some re-organisation, as the first sentence makes it very confusing. I would suggest to start by something like « AR5 assessed that the warming during 1998-2012 period was reduced relative to earlier decades, and subsequent analysis further confirm that this was due to the combine effect [...]. While the reduced warming in 1998-2012 is confirmed, updated observational products consistently suggest a larger warming over this period than what was assessed in AR5. It is virtually certain that global ocean [...]. [Jean-Baptiste SALLEE, France]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability.
105573	6	27	6	36	There are studies that have implicated changing patterns of anthropogenic aerosols as being important in driving the hiatus. Also, is it possible to say which of the two combined factors - solar+volcanic and internal variability - contributed the most? This may need a bit more unpacking given that solar and volcanic radiative forcing is so small. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. But the respective weight between the different drivers is impossible to assess with precision as clearly mentioned in the cross-chapter box3.2 and therefore there is no supported material in the chapter to go at such a level of detail.
87159	6	27	6	36	Please consider to split this para into two separate ones. The last sentence starting with "Since 2012, ..." could be the first sentence in a new A2.4 where you should consider to be more quantitative and additionally take onboard information regarding the phase and evolution of El Niño/La Niña events over this period. The NOAA website (https://www.ncdc.noaa.gov/sotc/global/201913/supplemental/page-2) also shows clearly how this has evolved since 1950. [Oyvind Christophersen, Norway]	Not applicable anymore. Last sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
42397	6	27	6	36	Is difficult to read [Tina Christensen, Denmark]	Noted. Statement completely rewritten
15031	6	27	6	36	The previous discrepancy was widely publicised and section A2.3 is a rather subtle response. A clearer statement incorporating the familiar, popular term 'hiatus' is suggested. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Noted . Statement completely rewritten to make it more focused and use the 1998-2012 as an example for modulation by internal decadal variability. The term "hiatus" is controversial as assessed in the Cross-ChapterBox3.2 and accordingly, we have decided to avoid this term.
129775	6	27	6	36	[PRECISION] Confusing. The first sentence reads as if the observational estimate of the 1998-2012 warming is now larger than it was for AR5 because of new or modified observational data. But the subsequent discussion is about analysis that elucidated competing mechanisms, rather than literal modifications to the observational record. Some rewriting is necessary to clarify the intent. [Trigg Talley, United States of America]	Taken into account. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. Statement completely rewritten and it was decided not to refer anymore to AR5 in this statement
12639	6	27	6	42	suggest to divide global surface temperature and ocean heat content (and other ocean interior changes) into two different bullet points [Lijing Cheng, China]	Not applicable. Former section A no longer exists in the revised SPM and the important information it contained has been incorporated in the 1st section 'state of the climate'
34965	6	27	6	42	The SOD claims that GMST has warmed strongly within the 5 years 2014-2018, these being claimed as the hottest 5 years in the instrumental record. Please see rebuttal comments #1, #2 and #3 above. [Jim O'Brien, Ireland]	Noted. Please see figure SPM1.b for annual temperature change.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65033	6	28	6	28	"observed reduced rate" – it should be clearer whether that is the (false) products used in AR5 or the updated ones used here. [Johannes Quaas, Germany]	Not applicable anymore. First sentence removed in the revised version HS10.1. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. Statement completely rewritten and it was decided not to refer anymore to AR5 in this statement
129777	6	28	6	32	Strike the sentence "Subsequent analyses have confirmed that the observed reduced rate..." to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Not applicable anymore. Statement completely rewritten
104377	6	28	7	29	Sentence should be amended to refer to "the observed rate of surface warming," not "observed rate of warming." Will help clarify the following text referring to natural variability, as per above comment #17 [Hunter Cutting, United States of America]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
36045	6	28			This sentence is too confusing - I don't know how to fix it. It assumes too much previous knowledge and talks about reduced being larger??? [Michael PRATHER, United States of America]	Noted. Statement completely rewritten
4089	6	29	6	30	'warming in 1998-2012... was due to ...solar, volcanic and internal variability'. It seems mean that the solar and volcanic forcing plays similar (OR even larger) role than the internal variability. But in actual the internal variability more important than the solar and volcanic? [Daoyi Gong, China]	Noted. But the respective weight between the different drivers is impossible to assess with precision as clearly mentioned in the cross-chapter box 3.2 and therefore there is no supported material in the chapter to go at such a level of detail.
25743	6	30	6	30	Please explain the concept of "regional contributions" in this context. [Don Alfonso Pino Maeso, Spain]	Noted. Changed by "pronounced regional and seasonal signatures" to make it clearer. The level of detail in the new HS10 is also considerably reduced.
50103	6	30	6	30	internal variability' is a bit abstract for average policy-maker - suggest this could be clarified to say 'internal climate variability' and point the reader to the Glossary definition. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. In the final (approved) version, footnote 28 defines natural variability, provides examples and points to the glossary et footnote 37 gives examples of internal variability.
69303	6	30	6	31	It is unclear whether "notable regional contributions from the Pacific and from a large part of Eurasia and North America in boreal winters" is due to internal variability or other external factors such as solar and volcanic forcing. [Kaoru Motosaki, Japan]	Noted. Changed by "pronounced regional and seasonal signatures" to make it clearer. The level of detail in the new HS10 is also considerably reduced and no examples is now provided.
24477	6	30	6	40	The large signal-to-noise ratio of temperature can be observed in the subtropics and the some part of mid-latitude (see Figure 9 in the Chapter 1). It is not appropriate to specify Tropics and Arctic only. It is better to describe more correctly. [Nobuhito Mori, Japan]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
104375	6	30	7	30	The term "natural variability" is not defined here for policy makers, and in any event the specific meaning is highly dependent on context. Authors should discard that term and explain in plain English variability in atmospheric warming due the variability of heat exchange with the other parts of the climate system, the oceans in particular, over monthly to decadal time scales. [Hunter Cutting, United States of America]	Taken into account. Footnote 28 of the final (approved) SPM defines natural variability.
129779	6	32	6	36	Quantifying this statement would be useful (e.g., warmed by 8%, etc.). [Trigg Talley, United States of America]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86557	6	33	6	33	"slowdown" is a bit unclear and potentially misleading (seen as cooling). May be "reduced rate of warming" is better. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Slowdown removed and replaced by "reduced trends in global surface temperature" in the new HS10
25739	6	33	6	33	Please specify that "slowdown" refers to the "observed reduced rate of warming". [Don Alfonso Pino Maeso, Spain]	Accepted. Slowdown removed and replaced by "reduced trends in global surface temperature" in the new HS10
70321	6	33			"the slowdown was only evident in the atmosphere and surface(very high confidence)". This is better to explain more in detail (maybe as a column?), that what was called "hiatus" " was proven not ture. [Masako Konishi, Japan]	Noted. The proposed reformulation now better highlight surface versus ocean fingerprint during this "hiatus "period.
129781	6	33			Change "and the slowdown was only evident in the atmosphere and surface" to "and the slowdown in the rate of warming was only evident in the atmosphere and at the surface" [Trigg Talley, United States of America]	Not applicable anymore. Statement completely rewritten
112143	6	34	6	34	I've noticed a tendency to refer to record high temperature as being the "hottest", regardless of the period or spatial domain considered, but is it really reasonable to refer to the global mean annual temperature in those terms? I would prefer the term "warmest". Hot, in laypersons' terms, is a word usually reserved for short-term extremes such as heatwaves or daily maxima, presumably used to reflect human experiences of such temperatures. Using it in this context seems to me to be somewhat emotive. I would expect such usage in the media, perhaps, but in scientific papers and an IPCC assessment, I'm not so sure. [Timothy Carter, Finland]	Not applicable. Last sentence removed.
17715	6	34	6	34	Should it be GMST or GSAT? [Anette Jönsson, Sweden]	Not applicable anymore. Last sentence removed.
27723	6	34	6	34	We suggest to update the period to 2015-2019 if more recent publications are available. [Eric Brun, France]	Not applicable anymore. Last sentence removed.
104031	6	34	6	34	Replace "GMST has warmed" with "GMST has increased" [Philippe Tulkens, Belgium]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
90737	6	34	6	34	Why to refer to GMST since it was announced earlier in the SPM that the AR6 would only deal with GSAT? [José Romero, Switzerland]	Not applicable anymore. Last sentence removed.
25741	6	34	6	34	Please replace "GMST has warmed" by "GMST has increased" [Don Alfonso Pino Maeso, Spain]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
117199	6	34	6	34	delete "past five years". (2014-2018) are not past 5 years! [Maisa Rojas, Chile]	Not applicable anymore. Last sentence removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6353	6	34	6	34	"warmed" could be changed to "increased". The global atmosphere warms, and this is indicated by increasing temperatures. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable anymore. Last sentence removed.
65505	6	34	6	34	Suggest clarification in using GMST, where explanatory text indicated GSAT. Consider using a consistent indicator or explain why a different one is used in any part of the report. [Kushla Munro, Australia]	Not applicable anymore. Last sentence removed.
46571	6	34	6	34	Why use GMST here rather than GSAT? [Dirk Notz, Germany]	Not applicable anymore. Last sentence removed.
18705	6	34	6	35	This statement may be updated by including 2019 in the final SPM [Govindasamy Bala, India]	Not applicable anymore. Last sentence removed.
15425	6	34	6	35	It has been confirmed by WMO that 2015-2019 is the hottest five-year period on record (Ref.: https://public.wmo.int/en/media/press-release/wmo-confirms-2019-second-hottest-year-record). Please consider revision. [SAI MING LEE, China]	Not applicable anymore. Last sentence removed.
41287	6	34	6	35	Can this information be provided based on GSAT, in-line with the overall AR6 shift towards this metric? [Alexander Nauels, Germany]	Not applicable anymore. Last sentence removed.
17577	6	34	6	35	A very good example of AGW groupthink and tunnel vision. Because warming in this so called "hottest" 5 year period 2014-2018 is most strongly influenced by El Nino natural variability and less by AGW-CO2. Not mentioning El Nino "short time weather" as the major cause for this hottest warming period is giving a wrong and false "climate alarm" message to policy makers. Chapter 3-P86 Line 12 reads "El Nino event in 2014-2016 led to 3 consecutive years of annual record GMST". Not mentioning this "natural variability" as major cause for the hottest 5 year period in the Summary for Policymakers is a very good example of strong "AGW" groupthink and tunnel vision [ferdinand meeus, Belgium]	Not applicable anymore. Last sentence removed.
42191	6	34	6	35	A2.3: Important recent trends. Are numbers available in GSAT? [Tina Christensen, Denmark]	Not applicable anymore. Last sentence removed.
81949	6	34	6	36	why is GMST the first reported observation, when Box SPM.1 says "Global surface air temperature (GSAT) is used as the principal surface temperature metric throughout this report"? [Dan Zwartz, New Zealand]	Not applicable anymore. Last sentence removed.
37231	6	34	6	36	Be comprehensive, open and transparent. Point out that the 2016-17 El Nino occurred late in the period being considered and caused higher global mean temperature ANOMALIES (not GMST). [John McLean, Australia]	Not applicable anymore. Last sentence removed.
65511	6	34	6	36	Suggest clarification. GMST is the first reported observation, however, Box SPM.1 states "Global surface air temperature (GSAT) is used as the principal surface temperature metric throughout this report". [Kushla Munro, Australia]	Not applicable anymore. Last sentence removed.
42643	6	34			Strange that the top level warming statement for this recent periods used GMST rather than GSAT ("..the principal variable used throughout this report") [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable anymore. Last sentence removed.
25745	6	35	6	35	It could be useful to specify the time span of the "instrumental record" the first time it is used in the text. [Don Alfonso Pino Maeso, Spain]	Not applicable anymore. Last sentence removed.
35259	6	35	6	35	At the end of this sentence you forgot to include a clause "a substantial portion of this record warmth was contributed by the unusually strong El Nino in 2015-16". [patrick Michaels, United States of America]	Not applicable anymore. Last sentence removed.
32351	6	35			The period covered by instrumental record could be mentioned here. [Clemens Schwingshackl, Norway]	Not applicable anymore. Last sentence removed.
36047	6	35			until 2018' ??? how about 'up to that period' [Michael PRATHER, United States of America]	Not applicable anymore. Last sentence removed.
129783	6	35			Change "until 2018" to "1850-2018" [Trigg Talley, United States of America]	Not applicable anymore. Last sentence removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81951	6	38	6	38	does “annual mean temperature” refer to GMST or GSAT, or both? [Dan Zwartz, New Zealand]	Not applicable. Bullet point removed from the revised SPM.
104033	6	38	6	38	exceeded compared to which period? [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed from the revised SPM.
8081	6	38	6	38	exceeded compared to which period? [Frank Dentener, Italy]	Not applicable. Bullet point removed from the revised SPM.
25747	6	38	6	38	Please specify whether "annual mean temperature" refers to GSAT or GMST. [Don Alfonso Pino Maeso, Spain]	Not applicable. The term ‘global surface temperature’ is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
65507	6	38	6	38	Suggest clarification on the use of "annual mean temperature". How is this different to GSAT or GMST? [Kushla Munro, Australia]	Not applicable. Bullet point removed from the revised SPM.
65513	6	38	6	38	Suggest clarification. Does “annual mean temperature” refer to GMST or GSAT, or both? [Kushla Munro, Australia]	Not applicable. Bullet point removed from the revised SPM.
46573	6	38	6	38	What is "recent", is this defined somewhere? In particular, relative to what are the "recent increases in temperature" measured? This should be made more concrete [Dirk Notz, Germany]	Not applicable. Bullet point removed from the revised SPM.
37629	6	38	6	38	Definition for "recent" is not clear. [Masahide Kimoto, Japan]	Not applicable. Bullet point removed from the revised SPM.
4545	6	38	6	39	This part is misleading. In many parts of the world, temperatures have still not left the longterm temperature variability within the context of the past millennia. In many parts of the world the Holocene Thermal Maximum was significantly warmer than modern temperatures. The same applies to the Medieval Climate Anomaly. I strongly advise against using global reconstruction which are still not stabilized and still change dramatically from one edition to the next. When using regional and local palaeotemperature proxy series, it becomes very clear that modern temperatures in many parts of the world are still well within the range of natural variability. This needs to be stated here. [Sebastian Luening, Switzerland]	Not applicable. Bullet point removed from the revised SPM.
38891	6	38	6	39	Your readers will need to know quite a bit about the context and be familiar with technical language to understand what is meant by "most clearly discernible emergence" and draw conclusions. I would suggest to rephrase the first two sentences of this paragraph to "Recent increases in annual mean temperature have exceeded levels of year-to-year variations in nearly all continental regions, indicating a human influence. Tropical land areas deviate the most clearly from natural variations, despite the amplitude of warming..." [Maike Nicolai, Germany]	Not applicable. Bullet point removed from the revised SPM.
104035	6	38	6	42	This paragraph should briefly explain the rationale why the emergence is stronger in the tropical regions despite the lesser amplitude of warming. [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed from the revised SPM.
42193	6	38	6	42	A2.4: Good example of short and precise bullet point. The message on Arctic sea ice is, however, repeated in B4.3. [Tina Christensen, Denmark]	Noted. The Arctic statement is now only introduced once (HS1.5)
129787	6	38	6	42	Figure 1.9 would be good to bring into the SPM at this point. [Trigg Talley, United States of America]	Not applicable. Bullet point removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131677	6	38		38	which mean temperature metric? [Hans Poertner and WGII TSU, Germany]	Not applicable. Bullet point removed from the revised SPM.
107781	6	38			When you write "Recent increases in annual mean temperature have exceeded levels of year-to-year variations in nearly all continental regions." where could I find answers concerning "nearly" ? In other words, which regions are concerned ? Should I have to read all these paragraphs {1.4.2, 1.4.3, 9.3.1, 9.3.2, 3.4.1} as to find the answer ? [FREDERIC MENARD, France]	Not applicable. Bullet point removed from the revised SPM.
36049	6	38			Do you mean GMST or GSAT - this is too fuzzy. [Michael PRATHER, United States of America]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
129785	6	38			Change "...continental regions." to "...continental regions, indicative of emergent and detectable signals of human-induced warming (high confidence)." [Trigg Talley, United States of America]	Not applicable. Bullet point removed from the revised SPM.
86075	6	39	6	39	"exhibit the most clearly discernible emergence" suggest rewording: "Tropical areas have warmed most clearly, well outside their normal temperature range, even though the total degrees of warming may not be as high as in temperate and arctic areas." [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Bullet point removed from the revised SPM.
54597	6	39	6	39	It would be clearer to say here "signal of emergence" which seems more in keeping with usage of this term in Box SPM.1. [Nancy Hamzawi, Canada]	Not applicable. Bullet point removed from the revised SPM.
131679	6	39	6	39	Based on your given definition of "Emergence" I dont understand, what the following sentence means: "Tropical land areas exhibit the most clearly discernible emergence, despite the amplitude of warming beeing smaller than in higher latitudes". Does that mean that tropical areas experienced more warmer days than usual? It would be very helpful, if you could translate your key message into a language, everybody can understand, avoiding scientific jargon such as "emergence". Using jargon increases the chances of being misinterpreted or misunderstood by reasers. [Hans Poertner and WGII TSU, Germany]	Not applicable. Bullet point removed from the revised SPM.
131681	6	39	6	39	tropical areas...most discernable emergence - could this be reworded to be less technical? Strongest signal? [Hans Poertner and WGII TSU, Germany]	Not applicable. Bullet point removed from the revised SPM.
87161	6	39	6	39	Currently it is not clear what is meant with "discernible emergence", and why this is so. Please consider to include an additional sentence that gives the rationale for this statement. The term "clearly discernible" itself is also challenging to understand from a non-English speaking perspective, maybe it could be replaced by either "apparant", "distinct" or "noticeable" in this context? [Oyvind Christophersen, Norway]	Not applicable. Bullet point removed from the revised SPM.
65517	6	39	6	39	Suggest clarification, since this statement is also true over oceans. For instance, see Wang et al. 2016, I J Climatol.; Power and Delage, Nature Climate Change, 2019. [Kushla Munro, Australia]	Not applicable. Bullet point removed from the revised SPM.
80073	6	39	6	40	It is very important to emphasize that the high emergence is mainly due to the lower internal variability of the tropical (annual mean) temperature. Please supplement the text with it. [Lilian Fejes, Hungary]	Not applicable. Bullet point removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81953	6	40	6	42	“more than half” attributions have led to misunderstandings in the past. A “best estimate” has more impact with policy makers and public. [Dan Zwartz, New Zealand]	Taken into account. HS1.5 now uses 'main driver', which is defined in a footnote.
65515	6	40	6	42	Suggest reconsidering the use of attributions, e.g. “more than half”. Attributions have led to misunderstandings in the past. Suggest changing to “best estimate” which has more impact with policy makers and public. [Kushla Munro, Australia]	Taken into account. HS1.5 now uses 'main driver', which is defined in a footnote.
86077	6	41	6	41	“it is very likely that human influence explains more than half of the summer sea ice retreat” – can this be said more clearly? E.g.” it is virtually certain that human influence explains [level of retreat at 99% level], and likely more.” [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. HS1.5 now uses 'main driver', which is defined in a footnote.
101523	6	41			Change "half of the summer sea ice retreat" to "half of the observed summer sea ice retreat" [Knut Nadelhoffer, United States of America]	Not applicable. We now talk about 'observed reductions in Arctic sea ice'.
37233	6	44	6	44	This assertion is based on unvalidated models. It is very unscientific to cite claims based on unvalidated models. [John McLean, Australia]	Noted. However, the climate models used in this report are better validated than models used in the previous report. The improvement in models including physical, chemical, and biological processes increases our confidence for the future projection compared to the previous report.
50105	6	44	6	46	A2.5 mentions observations of water cycle changes at the global scale but only discusses projections at the regional scale. Would it be possible to clarify that while there are challenges with projections at the regional scale, it can at least be assumed that at the global scale the water cycle will continue to be affected as the Earth's temperature rises (i.e. at the global scale, atmospheric water content has increased and will continue to do so)? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The global scale water cycle changes have been included in HS7 in the revised version.
117201	6	44	6	46	This statement seems at odds with statement A.1.5 [Maisa Rojas, Chile]	Taken into account. The statement has been revised to be more consistent with other statements
42195	6	44	6	46	A2.5: Leave out technical description in L44-46 [Tina Christensen, Denmark]	Accepted. Technical description has been removed in the revised version.
129791	6	44	6	46	Strike the sentence "Model limitations..." to help reduce the amount of text in the SPM. Recommend deleting "Nonetheless" and starting next sentence with "Internal variability will very likely..." [Trigg Talley, United States of America]	Taken into account. The statement has been revised accordingly.
65035	6	44	6	48	The summary is too weak in my opinion. As it stands, if I was a policymaker, I'd take from it that WG I cannot or does not want to say anything specific about precipitation. Why not say at least the sign of the global trend (e.g. of precipitation), at least for the future? And even if “strong quantitative model consensus” is not possible, why not at least say something about the expected qualitative changes? [Johannes Quaas, Germany]	Accepted. Aspects of water cycle changes in the past and near term have been strengthened across sections in the revised version.
15373	6	44	6	48	It is not only the model limitations that hamper model consensus but also stronger internal variability of water cycle. The relation between the two sentences are unclear. Need reconstruction of the sentences for clearer message of A.2.5. [Masaki Satoh, Japan]	Accepted. Sources of uncertainties in the water cycle changes have been added including internal variability and uncertainties related to model physics and natural and anthropogenic aerosol forcings in the revised version (HS.10.4).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97203	6	44	6	48	There is a certain mismatch between the statement "Model limitations including unresolved small-scale processes hamper strong quantitative model consensus for future hydrological responses at regional scales.", and the "high confidence" messages in section C.4 "Future changes of the water cycle" of the SPM. Continental/Regional hydrological models show clear change signals (for example dryer summers in the Mediterranean wetter winters in parts of Central and northern Europe) with a spread that is often not larger than that of the precipitation signals. Please refer to literature on the contribution of climate models and hydrological models to the overall uncertainty of hydrological projections (e.g. https://doi.org/10.1038/s41598-019-41334-7 ; https://doi.org/10.1016/j.ejrh.2018.06.004 ; https://doi.org/10.1007/s10584-016-1794-y) [Nicole Wilke, Germany]	Noted. In HS10, the statement has been revised to be more consistent with other statements.
80075	6	44	6	48	It is true for the models but what about observations? In many areas of the globe high annual/seasonal natural variability is the main cause that emergence (human activities) cannot be seen in the precipitation signal. And less importantly it depends on the climate model consensus. Please include this in the text. We suggest a little modification to the text: will continue to significantly influence... as it is still the case in many areas due to high natural variability. We would add to the end of the paragraph that this influence depends on the region and the season tough. [Lilian Fejes, Hungary]	Taken into account. Those aspects suggested have been reflected in the revised version (HS.10).
87897	6	44	6	49	This is another correct, but not essential paragraph for policy makers at this point. It is qualifying the information that policy makers will get in the future. This SPM should focus on the info they are getting now. [John Carstensen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The statements have been revised to provide more policy relevant information.
104037	6	44	6	49	Nonetheless. What elements of the hydrological cycle are sufficiently well included (i.e. not dependent on unresolved processes) that warrant a very likely statement on internal variability. [Philippe Tulkens, Belgium]	Noted. Main element assessed is precipitation. The statement has been revised to deliver more clear information.
67691	6	44	6	49	It is a little bit difficult to understand the relationship between the effects of human activity and internal variability. Even these sentences are scientifically correct, for example, it may be difficult to understand for ordinary person which effect is more important for future regional climate. [Hiroaki Kondo, Japan]	Taken into account. The new section of HS.10 in the revised version deliver more comprehensive information on the role of internal variability on near-term regional climate changes.
8083	6	44	6	49	Nonetheless. What elements of the hydrological cycle are sufficiently well included (i.e. not dependent on unresolved processes) that warrant a very likely statement on internal variability. [Frank Dentener, Italy]	Noted. Main element assessed is precipitation. The statement has been revised to deliver more clear information.
38893	6	44	6	49	I would suggest to swap the second and the third sentence of this paragraph (omiting the "Nonetheless" and connecting the sentence about the limitations to the previous one for exemple with "However"). Readers of the SPM will be more interested in what you know than in the limitations. [Maike Nicolai, Germany]	Taken into account. The statement has been revised largely.
129789	6	44	6	49	[CONFIDENCE] The claim of "high confidence" for a human induced change in the global water cycle needs to be aligned with the confidence language used in the Technical Summary. There, in Section TS.2.5.1, it is said that there is only "medium confidence" that the global water cycle has strengthened. [Trigg Talley, United States of America]	Taken into account. The statement and confidence level have been revised accordingly.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81211	6	44	6	50	"variability will significantly influence future regional trends in the water cycle over many land regions" It is important mentioning the concerned regions or at least give information on the part represented by these regions (50%, 20, 10?), this information should be of great interest for many readers and would help avoiding many misunderstandings regarding the future projections robustness [Fatima Driouech, Morocco]	Rejected. Modes of variability on different time scales affect water cycle differently. Thus, influences of variability on regional water cycle cannot be simply quantified.
36051	6	44			maybe 'on a global scale' since the effects are not just for global means [Michael PRATHER, United States of America]	Taken into account. The headline statement of HS10 highlight the influence on global to regional scales in the revised version.
65509	6	45	6	45	Suggest changing "consensus" to "agreement" or include an explanation of "model consensus" in Box SPM1. [Kushla Munro, Australia]	Not applicable. The sentence has been deleted.
93605	6	45	6	48	Section A.2 deals mainly with recent climate change. These few lines on future changes in the water cycle seem irrelevant to me, particularly because a complete section (C.4) is devoted to it. [Jean-Louis Dufresne, France]	Taken into account. The structure of the SPM has been largely changed and this statement has been largely revised.
101525	6	45			Change "limitations including unresolved small-scale processes hamper" to "limitations, including unresolved small-scale processes, hamper" [Knute Nadelhoffer, United States of America]	Noted. The part has been deleted in the revised version.
111437	6	46	6	46	Remove the word "nonetheless" as I don't see the following statement really depends in any way on the previous sentence. Internal variability will be important, regardless of model performance. [James Renwick, New Zealand]	Accepted. 'Nonetheless' has been deleted and the statement has been revised largely.
105575	6	46	6	48	It is very likely that internal variability will influence regional water cycle trends beyond mid-21st century if we are talking about short term trends of e.g. a decade. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. You are right that internal variability will affect throughout 21st and beyond. However, near-term influence of internal variability will be more substantial with weak signal. The statement has been revised accordingly.
107975	6	46	6	48	Statement may be misread to imply that internal variability will be weaker after mid-21st century than before mid-21st century. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted. You are right that internal variability will affect throughout 21st and beyond. However, near-term influence of internal variability will be more substantial with weak signal. The statement has been revised accordingly.
40847	6	46	6	49	Strange working, makes it sound as if internal variability will "likely" no longer be significant/observable after 2050? [TSU WGI, France]	Noted. You are right that internal variability will affect throughout 21st and beyond. However, near-term influence of internal variability will be more substantial with weak signal. The statement has been revised accordingly.
87293	6	46	6	49	It is not clear what is stated here. The intention is probably to say that internal variability on the regional scale can be the dominant factor for precipitation changes (but then it is not a trend). [Marcel Berk, Netherlands]	Taken into account. The statement has been revised largely in HS10.4.
42645	6	46			Perhaps a danger in the SPM that the 'Nonetheless...' statement implies changes due to anthropogenic effects may not be important. Suggest clarification e.g. "Nonetheless, in addition to anthropogenically induced changes, it is very likely...." [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. 'Nonetheless' has been deleted and the statement has been revised largely.
86079	6	47	6	47	Does "internal variability" refer to models or actual climate? What is the main message of this paragraph? That is not clear. Consider what is relevant to readers. Is it model accuracy or what the models project? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. "internal variability" refers to the actual climate. The statement has been revised to deliver clearer meaning in HS.10.4.
53457	6	47			replace "influence" by "modulate" and complete the sentence with "and will be therefore liable to enhance the forced climate response and the need for adaptation."? [Hervé Douville, France]	Taken into account. The statement has been revised largely.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50107	6	48	6	48	Does this statement focus on changes up to mid 21st century because beyond this point the changes are increasingly uncertain? It would be helpful to clarify projected trends in the water cycle beyond the mid 21st century too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Water cycle changes in mid- to long term are provided in HS.7 in the revised version.
36053	6	48			Does the report not document how humans have greatly altered the regional water cycle such as dams, erosion, clearing, peat draining? [Michael PRATHER, United States of America]	Not applicable. This is beyond the WGI scope.
29391	6	49	6	49	any trends of influence of internal variability on regional water cycle visible after mid-21st century? [Joachim Fallmann, Germany]	Noted. Internal variability will continue to influence regional climate and this aspect is mentioned in the HS10 of the revised version.
116077	6		6		HS A2 "discernible from natural variations" : why not use consistently the term "emerge"? [Valerie Masson-Delmotte, France]	Not applicable anymore. Headline statement (red box) removed.
116079	6		6		A2.3 please provide a quantification of the modulation of RF by solar and volcanic activity for the period 1998-2012 [Valerie Masson-Delmotte, France]	Rejected. This is not assessed in the core of the report (cross-chapter box 3.1).
81497	7	1	7	2	Recommnd to explain further on 'fingerprint of internal decadal variability'. [Ee Ling Lee, Malaysia]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
131683	7	1	7	2	'fingerprint of internal decadal variability' is technical langage, could this be reworded to be more accessible? [Hans Poertner and WGII TSU, Germany]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
25749	7	1	7	2	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
44707	7	1	7	5	Suggest changing the order of the first two sentences, for clearer messaging (sea level is changing). [Markku Rummukainen , Sweden]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
86081	7	1	7	6	Entire paragraph is unnecessarily technical. Please translate into more accessible language, remembering what is the main message for the policy reader. For instance "[First sentence is not understood.] It is very likely, statistically speaking, that human activities caused the sea level rise that has been observed over the past 50 years, though there is not enough evidence to confirm this on every coastline. There is also not enough evidence to demonstrate a clear link prior to 1970. By 2040 the human contribution to sea level rise should become clearly discernible and confirmed in all regions (medium confidence)."[Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. Note that the human attribution statement on global sea level rise is now found in HS1.7.
129793	7	1	7	7	Recommend leading with strong statement that "It is very likely that human-caused forcings are the main driver of the observed global-mean sea level rise." Then, follow with the qualifications about regional variations and pre-1971 contributions. Otherwise, the impact is diluted. [Trigg Talley, United States of America]	Taken into account. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. Note that the human attribution statement on global sea level rise is now found in HS1.7.
104039	7	1	7	7	Suggest to start with a statement + confidence on global sea level rise (quantitive). Then explain the differences of observed regional sea level rise with global. The final sentence may be interpreted as only median (50 %) confidence in global sea level rise by 2050, consider rephrasing. [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. Note that the human attribution statement on global sea level rise is now found in HS1.7.
104041	7	1	7	7	Similarly to the paragraph A.2.6. about oceans, a paragraph should be dedicated to land and the associated emergence of human-caused signal. [Philippe Tulkens, Belgium]	Rejected. Instead, we have decided to remove the paragraph on oceans, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8085	7	1	7	7	Suggest to start with a statement + confidence on global sea level rise (quantitative). Then explain the differences of observed regional sea level rise with global. The final sentence may be interpreted as only median (50 %) confidence in global sea level rise by 2050, consider rephrasing. [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers. Note that the human attribution statement on global sea level rise is now found in HS1.7.
50113	7	1	7	7	The second sentence in A2.6 is quite confusing. It could be rephrased to say '...attribution of past regional changes remain difficult, specifically quantifying consistently all of the contributions to the global sea level before 1971 or all contributions to regional sea level changes.' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
36055	7	1			We use decadal to cover all sins, are you happy with this if we are talking about multi-decade climate patterns? [Michael PRATHER, United States of America]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
23333	7	2	7	5	This sentence should be re written. I don't give suggestions since I can't fully understand the sentence. [Anna Amelia Sörensson, Argentina]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
131685	7	2	7	5	convoluted sentence - please make understandable [Hans Poertner and WGII TSU, Germany]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
17579	7	2	7	6	There is no solid evidence for an acceleration in sea level rise. Tide gauge measurements show linear increase of about 1,5-2 mm/year with no acceleration. There is no solid evidence for the statement that "human-caused forcings are the main driver" because the current trend in sea level rise started well before 1950. More than 100 years of tide gauge data show linear increases of about 1,5-2 mm/year, with local variations due to local specific land conditions. And tide gauge measurements are most relevant for local coastal planning. [ferdinand meeus, Belgium]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
101527	7	2			Change "are the main driver" to "are the main drivers" [Knut Nadelhoffer, United States of America]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
111439	7	3	7	3	"remains" [James Renwick, New Zealand]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
14553	7	3	7	5	Suggested minor edits to improve readability "....attribution of past regional changes remain a challenge in terms of consistent quantification of (a) all contributions to the global sea level before 1971, and (b) all contributions to regional sea level changes. [Roshanka Ranasinghe, Netherlands]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
42197	7	5	7	6	A2.6: "human-caused signal" is a too technical term. Maybe use: "Nonetheless, the impact of human activities is projected to..." or "...anthropogenic impact..." [Tina Christensen, Denmark]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
24451	7	5	7	7	The description of expected area (50%) is better to specified as "starting from Tropics at over 50%" [Nobuhito Mori, Japan]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
37235	7	6	7	6	Explain how something can apply to "over 50% of the ocean area" but not to the rest of the ocean area. [John McLean, Australia]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
25751	7	6	7	6	The words "regardless of future emissions" does not appear in the underlying chapter (chapter 9 page 87). [Don Alfonso Pino Maeso, Spain]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69305	7	6	7	6	It would be better to rephrase “future emissions” to “future GHG scenarios” or “future GHG concentrations”. [Kaoru Magosaki, Japan]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
110777	7	6	7	6	"regardless of future emissions" is a bit puzzling [cathy clerbaux, France]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
36057	7	6			emerge' again. Does this mean largest or statistically detectable. For the SPM we want the former, as D&A scientists we grab at the latter. [Michael PRATHER, United States of America]	Not applicable . Bullet point removed to shorten the SPM and focus on what is the most relevant for policy-makers.
27727	7	10	7	10	The title is not reflective of what this section is about. The notion of 'integrated knowledge is not clear'. Maybe 'communicating about climate change' would be more appropriate. We think this section is essentially about: how co-constructing relevant indicators with impacted communities make them more aware of climate change and its consequences. Still, we would like to delete it (see relevant comment). [Eric Brun, France]	Not applicable. Section removed.
88881	7	10	7	19	I was unsure if it is appropriate to include this in WG1? After all WG1 is about the physical sciences and really is facts, not solutions. By including this type of information we open WG1 to attacks. [Thorsten Mauritsen, Sweden]	Accepted. Section removed
129795	7	10	7	48	[RISK] Section A.3 addresses the challenges of developing and delivering effective climate messaging, and the impact of the values and beliefs of those giving and those receiving the message on how it is received and utilized. Paragraph A.3.4 discusses storyline approaches to address unpredictable, "low likelihood, high impact" climate events. Note that, as the number of such "low likelihood, high impact" possible outcomes increases, the likelihood that at least one of these events will take place increases, and could easily exceed 50-50, especially under higher-emissions, greater warming scenarios. The challenge is that there is no way at this time to predict which of the "low likelihood" scenarios will come to pass, and when it will occur. This section of the WGI report should clearly communicate this fact, which serves to underline the importance of prompt and effective policy action to limit global warming. [Trigg Talley, United States of America]	Not applicable. Section removed.
65037	7	10	7	48	I find this entire section almost useless. I don't see a real conclusion. It seems to say AR6 WG I says things in a more relevant way than did AR5. But that the reading policymaker should judge herself. Unless we can produce actual conclusions, I don't see the merit of this section at all. [Johannes Quaas, Germany]	Accepted. Section removed
42013	7	10	7	48	Please, merge section A3 with D5 and place it to D section (provided the current structure remains). [Juhani Damski, Finland]	Not applicable. Section removed.
86559	7	10	7	48	Not sure what I learned from reading that section A.3. It is very generic text. What is new? I could imagine the eexact same text being written at the time of AR5. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Section removed
37411	7	10	7	48	This whole section should be removed because it is outside the IPCC's remit, which is to ... "assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation." Quite clearly the remit says nothing about communication of such issues. [John McLean, Australia]	Accepted. Section removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17449	7	10	7	48	I have made numerous very specific comments about this section (A.3) but generally, it doesn't seem to fit or be of much use to policymakers. It is very hard to assimilate. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Section removed
69967	7	10	7	48	I think some of stories in Section A.3 has similar meaning with Section D.5. It needs some arrangement. [Young-Hwa BYUN, Republic of Korea]	Accepted. Section removed
104043	7	10	7	48	Section A.3 is not very informative, especially for policy-makers. It could be removed from the SPM and replaced with paragraphs dedicated to more policy-relevant information. This section is also very similar to Section D5. [Philippe Tulkens, Belgium]	Accepted. Section removed
42349	7	10	7	48	Rather technical information on methods and communications tool that might not be valuable to policy makers. [Tina Christensen, Denmark]	Accepted. Section removed
86905	7	10	7	48	A lot of the points made in section A3 are quite general and lack specificity in order to be useful for policy-makers. Moreover, in the interest of shortening the length of the SPM, we suggest either removing this section wholesale or condensing the points made into one or two key messages (these can also be integrated into other sections of the SPM). [Oyvind Christophersen, Norway]	Accepted. Section removed
93607	7	10	7	48	Section A.3 looks very strange and mostly out of purpose in this WG1 report. We (as I am part of the community) are qualified to assess knowledge on the physical process of climate change, we are not qualified to assess the relevance of the way we communicate or we interact with the other communities. This could have its place in the synthesis report, and in any case more in the form of a motivation for what has been done than an assessment of what has been done. [Jean-Louis Dufresne, France]	Accepted. Section removed
97205	7	10	7	48	We suggest considerably shortening Section A.3. It contains important information about the increased knowledge, new methodologies and better communication, and storylines. However, A.3 is too long, some of the information is provided elsewhere and explained in a better way. [Nicole Wilke, Germany]	Taken into account. Section removed while addressing other comments.
42199	7	10	7	48	A3: Could be removed from SPM entirely? Not clear in context of the the WGI SPM. And the content is to some extent covered by section D. [Tina Christensen, Denmark]	Accepted. Section removed
50499	7	10	7	49	This section overlaps quite strongly with the information presented in section D5 (Climate information and societal linkages) and it would be useful to ensure there is no duplication across SPM sections. This would help with ensuring that clear key messages are present throughout the document. It's a little unclear why these two subjects (communications science, and how climate impact drivers are changing) are communicated together - they don't seem like natural bedfellows and the logic is hard to follow. The information on drivers should either move to A2, or the links between these two topics made clearer within A3. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Section removed
105577	7	10	7	52	Section A.3 breaks the flow of the SPM here, I think. Perhaps it would be better at then end as it seems to 'hand-over' to WGII? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Section removed
17439	7	10			This is unclear. Is it actually about 'An integrated approach to communication'? Even so, it isn't particularly meaningful. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89903	7	10			This section presents valuable new information but lacks focus which causes it to be a bit lengthy. The section needs to be more concise and focus to be effective to the reader. [Joanne Deoraj, Trinidad and Tobago]	Taken into account. Section removed while addressing other comments.
27725	7	10			Though A3 address original and interesting aspects of communication on climate change, we are not convinced that those aspects should be mentioned in the SPM of the WG1 report. They are more related to socio-economic aspects such as behaviour and enabling conditions for action. We suggest to delete A3 and move its interesting findings into section D.5. [Eric Brun, France]	Accepted. Section removed
110977	7	10			This intention of this paragraph is unclear. Is this about 'An integrated approach to communication'? Or "an integrated approach to knowledge" [Monica Dean, United States of America]	Not applicable. Section removed.
99971	7	10			Section A3 on integrated knowledge and user needs/engagement takes up a lot of space at beginning of the SPM seem to be very lengthy. Recommendation is that section be shortened. [Caroline Eugene, Saint Lucia]	Accepted. Section removed
68793	7	10			Section A should be shortened significantly. Areas such as A3 on integrated knowledge and user needs/engagement is vague. [Jeffers Cheryl, Saint Kitts and Nevis]	Taken into account. Section removed while addressing other comments.
129797	7	12	7	12	Is there a difference between "managed" and "human" systems? Suggest removal of "managed" since following text only refers to natural and human systems. [Trigg Talley, United States of America]	Not applicable. Section removed.
130439	7	12	7	12	Please consider word "managed". [Panmao Zhai, China]	Taken into account. 'manage' no longer appears when talking about CIDs
37783	7	12	7	12	Like the approved AR6 synthesis report outline, it seems appropriate to delete the expression 'managed' here. [Junhee Lee, Republic of Korea]	Taken into account. 'manage' no longer appears when talking about CIDs
25753	7	12	7	12	A definition of "natural, managed and human systems" should included, especially for "managed systems". [Don Alfonso Pino Maeso, Spain]	Taken into account. 'manage' no longer appears when talking about CIDs
110779	7	12	7	12	"managed" means? [cathy clerbaux, France]	Taken into account. 'manage' no longer appears when talking about CIDs
50115	7	12	7	12	Please clarify here that change in CIDs can be both positive and negative, and if the observed impacts have been predominantly negative that impacts have been overwhelmingly negative. In the first sentence of A3 please clarify whether it is the type or the severity or both of the climatic impact driver that are changing with global warming. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere. Note that footnote 36 in the final (approved) version explicitly mentions that impacts be positive.
87321	7	12	7	13	first sentence is too separated from the remaining text; should come later when the subject of this paragraph is clear. [Marcel Berk, Netherlands]	Taken into account. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere. Note that ,in the final (approved) version, Climatic impact-drivers are defined in footnote 36
20331	7	12	7	13	Would not it be more exact to state that the magnitude and influence of CID are changing? Looking across chapter 12, every CID investigated when discussing projections seems to be already with us. [philippe waldteufel, France]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere. Note that the CID assessment in ch12 is based on direction on change.
17441	7	12	7	15	The specific link between the first and second sentences isn't obvious. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere. Note that ,in the final (approved) version, Climatic impact-drivers are defined in footnote 36

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110979	7	12	7	15	The specific link between the first and second sentences isn't obvious. [Monica Dean, United States of America]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
112145	7	12	7	19	This section is very welcome in WG I - well done for including it. Having said that, user needs are mentioned here out of the blue. Users of what and for what? What is actionable climate information? Actionable for what? Some linking sentence is needed to explain that information on climatic impact-drivers (my hyphenation) can be important for many actors and decision-makers needing to plan for a changing climate. It would probably also be useful to mention here that climate information alone may be necessary, but is very often, indeed usually not sufficient for addressing climate change risks. Information on other environmental and socioeconomic drivers that affect exposure and vulnerability are also required, which are dealt with in more detail in WG II. If the heading here is "Integrated Knowledge" then these other aspects really need to be acknowledged here as well, even if only the climatic impact-drivers are treated in WG I. If this isn't stated up front, then an impression may be conveyed that once the relevant climate information can be identified and made "actionable", risk assessments can proceed and solutions found. In most cases, nothing can be further from the truth. In most policy settings, climate change is but one of a many drivers affecting exposed systems and actors. The trick is to tease out what types of climate-related drivers potentially pose risks (or opportunities) for those systems/actors and then how to propose solutions for adapting to those risks/opportunities. [Timothy Carter, Finland]	Not applicable. Section removed while addressing other comments.
131687	7	12	7	19	Giving two or three examples for relevant "climate impact drivers" would really help to understand your messages in A.3. Without examples your headline message and message A.3.2. stay very abstract and are difficult to understand. [Hans Poertner and WGII TSU, Germany]	Taken into account. Climatic impact-drivers are defined in footnote 36 of the final (approved) version. Note that FAQ12.1 is also about climatic impact-drivers.
131689	7	12	7	19	The headline statement could be better formulated to deliver a key message that is supported by the bullets - is this section about climate change communication, climate change services or underatanding risk? [Hans Poertner and WGII TSU, Germany]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
86907	7	12	7	19	Please consider to shorten this highlighted conclusion. Please consider if the first sentence is redundant. For us this statement is kind of obvious, and isn't necessarily needed. The rest of the highlighted conclusion presents in our view interesting and policy relevant information that should be retained [Oyvind Christophersen, Norway]	Taken into account. This headline statement has been removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
40835	7	12	7	19	SPM <-> TS: This comment relates to finding support for a particular SPM headline statement in the TS: Where is the support in the TS for this SPM headline statement : "Climatic impact drivers that affect natural, managed and human systems are changing with global warming (high confidence). Since AR5, there has been considerable progress in understanding user needs, in better facilitation of user engagement and in applying co-design and co-development processes to generate actionable climate information (high confidence). The construction and communication of climate change information for risk assessment is strengthened by the use of multiple lines of evidence and the consideration of low-likelihood but potentially high-impact events. (SPM Box.3) {1.1, 1.2, 4.8, 10.3, 10.5, 10.6, 11.2, 12.1, 12.2, 12.3, 12.4, 12.5, Atlas.1, TS.4.1, Box TS5 Figure 3}" The SPM calls out to Box TS5 Figure 3, but there is no uncertainty language in this Figure. [TSU WGI, France]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
112777	7	12	7	19	The wording "climate impact driver" is really problematic here. As noted in a previous comments, one issue is that typically impacts refer to observed/realised impacts, whereas for the future terms like "risks" would be used. But more importantly, this sentence now becomes way more complicated than it needs to be -- wouldn't "Global warming is affecting natural, managed and human systems (high confidence)" work as well? [Maarten van Aalst, Netherlands]	Rejected. Introducing "risk" implicitly means negative impacts, which is not the purpose of CIDs in the WGI assessment. The suggested alternative, "Climate Driver", could be also be interpreted as a driver of the climate. The term has been retained but a dash has been added to form "Climatic impact-drivers" in an attempt to not be in contradiction with WGII's definition that refer to impacts being past changes.
76949	7	12	7	19	What is the message for policy here? Taking account of the risks of high impacts events is important, and planned for across multiple sectors and social dimensions. [Emer Griffin, Ireland]	Taken into account. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
108181	7	12	7	19	Will the average policymaker understand what co-design and co-development processes are? [Anton Holland, Canada]	Taken into account. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
5277	7	12	7	19	This red box is filled with jargon. The worst is "better facilitation of user engagement and in applying co-design and co-development processes to generate actionable climate information". What a mouthful. Do you mean people are working together to improve information relevant to policy decisions? The phrase "climate impact driver" is also IPCC jargon. The last sentence ("The construction...") is OK. [Daniel Murphy, United States of America]	Taken into account. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
104373	7	12	7	19	This statement is support by a lot of literature, and is critical for establishing the inclusion of multiple lines of evidence and consideration of low-likelihood but potentially high-impacts in this SPM which is explicitly write for policy maker. However, it appears that there is no support for this specifica statement in the text below the Headline statement, no line of sight to the underlying literature. [Hunter Cutting, United States of America]	Taken into account. Low-likelihood, high impact outcomes are now the focus of HS12
101529	7	12			Change "affect natural, managed and human systems" to "affect natural, managed, and human systems" [Knute Nadelhoffer, United States of America]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36059	7	12			"Climatic impact drivers" - it is not clear what this includes (emission of CO ₂ , fossil exploration, catalytic converters? is it a Hags or the action?) and you need to define it at the front. We never used this form in previous AR. [Michael PRATHER, United States of America]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere. Note that footnote 36 in the final (approved) version explicitly mentions that impacts be positive.
87451	7	13	7	13	The word 'user' is new here and unexpected. The previous sentence does not prepare the reader for this register. [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. 'User' no longer mentioned in the final (approved) SPM.
23335	7	13	7	14	This is the first time "user" is used in the SPM. I would suggest to explicit what type of user we refer to, for example "user of climate information". [Anna Amelia Sörensson, Argentina]	Taken into account. 'User' no longer mentioned in the final (approved) SPM.
131691	7	13	7	14	Not clear who is meant by "user", e.g. user needs, user engagement. Suggestion to reformulate [Hans Poertner and WGII TSU, Germany]	Taken into account. 'User' no longer mentioned in the final (approved) SPM.
17443	7	13	7	15	2nd sentence of this para, specifically, '...in applying co-design and co-development processes to generate actionable climate information'. It may be an important point, but the language makes it inaccessible. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This headline statement has been removed from the revised SPM and the important information it contained has been incorporated elsewhere.
20333	7	13	7	15	After reading the SOD, one is far from convinced. Nowhere is found a testimony of users acknowledging that their needs have been better understood in recent years (of course this reader may have missed such references). Moreover, the examples given in chapter 10 ignore any co-design and co-development in the described approach [philippe waldteufel, France]	Noted. Comment is not requesting any changes to the text.
86909	7	13	7	15	Not clear who "user" is, please be more specific. [Oyvind Christophersen, Norway]	Taken into account. 'User' no longer mentioned in the final (approved) SPM.
110981	7	13	7	15	Co-design' and 'Co-development' are not commonly understood terms and it is unclear what this sentence is trying to say. Is it "incorporating users in the design and development"? [Monica Dean, United States of America]	Taken into account. The terms have been removed from the revised SPM.
36061	7	13			"user" needs to be defined, could be anyone or thing, how about starting simply with "users of climate information" ? [Michael PRATHER, United States of America]	Taken into account. 'User' no longer mentioned in the final (approved) SPM.
66517	7	14	7	14	It is not only the codesign that has progressed toward this goal. The production of climate information at a scale relevant to impacts has progressed also. I would add "user needs, provision of climate information at a relevant scale, in better facilitation..." [robert vautard, France]	Not applicable. A.3 has been removed from the SPM.
36063	7	14			"co-design co-development" Wow, this is WGII jargon (and I remember it well) and for WGI, please define or use dictionary terms. [Michael PRATHER, United States of America]	Taken into account. The terms have been removed from the revised SPM.
9479	7	15	7	15	It is unclear what is meant by 'the construction and communication of climate change information'. Why use the verb 'construction'? Seems like jargon not plain English suitable for a diverse language audience. What are you actually trying to say here? Also remove/clarify in line 22 and 39 [Joelle Joelle Gergis, Australia]	Taken into account. HS A.3 has been removed from the SPM.
129799	7	15	7	15	The word "actionable" may border on policy-prescription. Suggest "decision-relevant climate information" as a more policy-neutral formulation. [Trigg Talley, United States of America]	Taken into account. "actionable" no longer in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104045	7	15	7	15	The high confidence statement looks a bit awkward, in the context of the previous sentences that basically describe efforts, rather than observed variables. Suggest to omit the confidence statement. [Philippe Tulkens, Belgium]	Accepted. The text has been revised and (partly) moved to the introduction of the 3rd section on climate information for risk assessment and regional adaptation. The confidence language has been removed.
8087	7	15	7	15	The high confidence statement looks a bit awkward, in the context of the previous sentences that basically describe efforts, rather than observed variables. Suggest to omit the confidence statement. [Frank Dentener, Italy]	Accepted. The text has been revised and (partly) moved to the introduction of the 3rd section on climate information for risk assessment and regional adaptation. The confidence language has been removed.
25755	7	15	7	17	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
111627	7	17	7	18	I couldn't find any discussion of low likelihood, high impact events in Box SPM.3 [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This is now explicitly discussed in HS12.
112147	7	22	7	22	Are these "methodologies" or "methods"? I suspect probably the latter, possibly within the context of a few competing analytical frameworks that might be described as the former. [Timothy Carter, Finland]	Not applicable. Section removed.
54601	7	22	7	22	This entire paragraph is circular and uninformative. It states that, "There is high confidences that ... increases confidence". It is unclear from the underlying text how the 'high confidence' assessment was arrived at, nor how confidence is climate change messages (presumably the confidence ascribed by a user or stakeholder) is measured. [Nancy Hamzawi, Canada]	Not applicable. Section removed.
129801	7	22	7	23	Relevant is being used redundantly here. [Trigg Talley, United States of America]	Not applicable. Section removed.
129803	7	22	7	23	The term 'relevant' is used twice in the sentence. Maybe revise the second use as useful or applicable? [Trigg Talley, United States of America]	Not applicable. Section removed.
25757	7	22	7	23	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
88883	7	22	7	27	This paragraph seems like a self-assessment of WG1's ability to communicate. I think this should be removed. [Thorsten Mauritsen, Sweden]	Not applicable. Section removed.
42399	7	22	7	27	long section [Tina Christensen, Denmark]	Not applicable. Section removed.
50117	7	22	7	27	It is unclear what is meant by a 'climate message'. "Distilling climate messages" could be changed to say "Distilling the key messages of climate science research" to explain this better. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
117203	7	22	7	27	text is a bit repetitive about the "different lines of evidence" . Already said in section A.1 [Maisa Rojas, Chile]	Not applicable. Section removed.
104047	7	22	7	28	The sentence reads strange: There is high confidence that xxx,yyy, zzz increases confidence. The two 'confidences' are probably not the same. How is a 'subjective' confidence level in climate change messages measured, such that we can have high confidence that it worked? Suggest something like: AR6 brings to gether a number of lines of evidence that provide the basis for a higher level of confidence in climate change messages. [Philippe Tulkens, Belgium]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8089	7	22	7	28	The sentence reads strange: There is high confidence that xxx,yyy, zzz increases confidence. The two 'confidences' are probably not the same. How is a 'subjective' confidence level in climate change messages measured, such that we can have high confidence that it worked? Suggest something like: AR6 brings to gether a number of lines of evidence that provide the basis for a higher level of confidence in climate change messages. [Frank Dentener, Italy]	Not applicable. Section removed.
29197	7	23	7	26	This sentence is difficult to understand. diverse analysis methods and expert judgment -> diverse analysis methods, and expert judgment [Hiroshi Kanzawa, Japan]	Not applicable. Section removed.
109297	7	23	7	26	This sentence is quite confusing as written. Is the "high confidence" about *distilled* messages, which suggests that they have been reduced to an essence (potentially omitting the evidence lines that follow this statement)? Or is it about messages that *include* the multiple lines of evidence, and if so, separately or together? How does one "distill" messages from multiple lines of evidence? As for the last part of the sentence, *whose* confidence is increased? The public's? How measured, and if measurable, are those measures comparable across national and cultural boundaries? I think this bullet needs considerable revision. Perhaps a phrase such as "brief, clearly written, and simply presented messages that summarize multiple lines of evidence" would be a start — but perhaps that's not what you mean. [Paul Edwards, United States of America]	Not applicable. Section removed.
20335	7	23	7	27	What do the users say? Do they confirm that their confidence into climate change messages is increased thanks to distillation of potentially contrasting lines of evidence, for example? Possibly the references which say so have escaped this reader. Otherwise WG1 authors ought to provide some [philippe waldteufel, France]	Not applicable. Section removed.
36065	7	23			"range of USERS and regional scales" Rest of A.31 is very nice. [Michael PRATHER, United States of America]	Not applicable. Section removed.
54599	7	24	7	24	Recommend deleting the phrase "potentially contrasting" here. Flagging to readers that lines of evidence might, in some cases, be contrasting, seems to distract from the main message here that synthesizing/distilling information from multiple lines of evidence increases confidence in results (consistent with results shown in SPM Box.3). If evidence is contrasting, then it would be a reason for lower confidence in results so again, this phrase does not seem to fit. [Nancy Hamzawi, Canada]	Not applicable. Section removed.
37413	7	24	7	26	Cease your mendacity. Simulated data, theoretical understanding and expert judgement are NOT evidence. You need empirical evidence to support your claims and you simply don't have it. [John McLean, Australia]	Not applicable. Section removed.
101531	7	24			Chage "relevant to" to "for a" [Knut Nadelhoffer, United States of America]	Not applicable. Section removed.
53459	7	24			not sure to understand how "contrasting evidence" may increase the confidence in CC messages for most people? [Hervé Douville, France]	Not applicable. Section removed.
101533	7	25	7	26	Change "observed, paleoclimate proxy and simulated data, theoretical understanding, diverse analysis methods and expert judgment increases confidence in climate change messages" to "observed paleoclimate proxy and simulated data, theoretical understanding, diverse analysis methods, and expert judgment increases confidence in climate change messages" [Knut Nadelhoffer, United States of America]	Not applicable. Section removed.
129805	7	26	7	26	Can "expert judgement" be quantified? This phrasing might raise red flags. [Trigg Talley, United States of America]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23337	7	26	7	26	Here "confidence" is used outside of the calibrated language "There is high confidence that ... (X and Y)....increases confidence in climate change messages". Is this confusing? Can another word be used? (this goes back to CH10 ES so should also be changed there) [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed.
27729	7	26	7	26	Please specify the confidence of whom. [Eric Brun, France]	Not applicable. Section removed.
81821	7	26			Replace "climate change" with "the" such that the end of the sentence reads "...increases confidence in the messages" [Dan Zwartz, New Zealand]	Not applicable. Section removed.
27731	7	29	7	29	What are these drivers? A short list of main climatic impact drivers or at least a reference to the next part could be added here. [Eric Brun, France]	Not applicable. Section removed.
37415	7	29	7	31	Any "tailored indices" and "thresholds" are man-made constructs. You need to show that they have any merit. [John McLean, Australia]	Not applicable. Section removed.
129807	7	29	7	35	[PRECISION] What is this paragraph attempting to convey? It needs to be understandable to a broad audience unfamiliar with IPCC jargon. Please provide some examples of the "climate impact drivers" to which authors refer. [Trigg Talley, United States of America]	Not applicable. Section removed.
17445	7	29	7	35	This is obviously important but, as it stands, its meaning and significance is unclear (at least to a non-specialist) and it therefore raises the question, 'How does this help policymakers?' [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
104049	7	29	7	35	Not clear to what medium confidence pertains? That there is direct relationship, or that are many indices? Clarify whether this statement pertains to land-regions only. [Philippe Tulkens, Belgium]	Not applicable. Section removed.
8091	7	29	7	35	Not clear to what medium confidence pertains? That there is direct relationship, or that are many indices? Clarify whether this statement pertains to land-regions only. [Frank Dentener, Italy]	Not applicable. Section removed.
34511	7	29	7	35	A3.2 seems both astonishingly vague and jargony. This might be mitigated through inclusion of a very brief example. [Russell Vose, United States of America]	Not applicable. Section removed.
37631	7	29	7	35	The use of the new term, "climatic impact drivers", obscures what was observed for which variable. [Masahide Kimoto, Japan]	Not applicable. Section removed.
36067	7	29			"Climatic impact drivers" (CIDs) again. You really need a brief clarification in the text for these new-to-WGI-AR6 cycle ideas. There is a tautology here: by their name they must change climate, but you say here the link only occurs for "many" are. The problem here is that there is no presentation as to why we care about the CIDs. There is a confusion as to whether CIDs impact human systems or are caused by humans. Since CIDs by definition affect climate then of course they affect "a range of natural and human systems" This whole section needs to be introduced with clear examples and with why we care about indices. For example, would we put here a discussion about GWP/GTP indices? [Michael PRATHER, United States of America]	Not applicable. Section removed.
129809	7	30	7	30	What do authors mean by "tailored"? It could be mis-interpreted by a policymaker/reader. [Trigg Talley, United States of America]	Not applicable. Section removed.
109299	7	30	7	30	"indices tailored to represent" would be syntactically clearer. Otherwise, what's a "tailored index"? [Paul Edwards, United States of America]	Not applicable. Section removed.
101535	7	30			Change "multiple variables and their interactions" to "multiple variables, and their interactions" [Knute Nadelhoffer, United States of America]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23339	7	31	7	32	"A direct relationship with global warming is identified for many indices describing climatic impact drivers (medium confidence)." I find it confusing to have "many indices" and "medium confidence". For example a statement like the following would carry more meaning (I don't know if it is possible, it is just an example) "A direct relationship with global warming is identified for some indices describing climatic impact drivers (high confidence)." [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed.
32353	7	31	7	32	It seems a bit contradictory to me that direct relationships have been "identified", but confidence is only medium. In my understanding, confidence should be higher if they were identified. [Clemens Schwingshackl, Norway]	Not applicable. Section removed.
86911	7	31	7	32	The sentence starting with "A direct relationship" is currently vague. The sentence could rather try to specify this relationship more by describing which indices that are connected to climatic impact drivers. It is good that you refer to SPM Box.3 since more detailed information is available there. [Oyvind Christophersen, Norway]	Not applicable. Section removed.
41289	7	32	7	33	Have the climatic impact drivers only 'changed' or actually 'strengthened'? Even if seasonal precipitation decreased, this would be considered a strengthened driver, correct? [Alexander Nauels, Germany]	Not applicable. Section removed.
112149	7	32	7	34	I'm not sure how useful this statement is..Somehow it misses the sense of climate change attribution that's needed for the statement about recent changes, and committed climate changes in the future, that seems to be implied by the statement about emissions scenarios. Much the same statement could just as well have been made in relation to natural variability and one might then conclude: "sure, climate changes and will continue to change - big deal". [Timothy Carter, Finland]	Not applicable. Section removed.
37417	7	32	7	34	An utterly banal statement. Climate has always changed and always will. It seems to be only the IPCC that is surprised by this. [John McLean, Australia]	Not applicable. Section removed.
50121	7	32	7	34	...world multiple climate drivers changing in recent decades, and being projected to continue to change over the 21st century regardless of the emissions scenario': makes it sound as if the emissions scenario is immaterial - presumably we would expect to see greater changes in proportion to the emissions scenario. Can the sentence reflect this? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
20337	7	32	7	35	See comment on lines 12-13 above [philippe waldteufel, France]	Not applicable. Section removed.
86083	7	33	7	33	Suggest that third sentence is main message, so move to top of paragraph. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Section removed.
14555	7	35	7	35	I think 12.5.2 should be replaced by 12.5.1 here [Roshanka Ranasinghe, Netherlands]	Not applicable. Section removed.
89645	7	37	7	37	I find this statement problematic in a WG1 SPM - the way I read this, it implicitly states that we are all biased in our messaging of the scientific basis, which to me undermines the entire report. [Trude Storelvmo, Norway]	Not applicable. Section removed.
90739	7	37	7	38	Is WG I mandated (and able) to discuss "values and beliefs"? [José Romero, Switzerland]	Not applicable. Section removed.
25759	7	37	7	38	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.

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27733	7	37	7	40	This is an important issue, developed in the report, but it is not clear what this paragraph, especially the final line, is intended to communicate and it could confuse more than inform - maybe rephrase. [Eric Brun, France]	Not applicable. Section removed.
98579	7	37	7	41	Section A.3.3 could benefit from inclusion of the argument to ensure multidisciplinary approach to communicating climate change, e.g. involving artists and cultural institutions for constructing more powerful, engaging and accessible climate change messaging that go beyond scientific facts and datasheets. For more, see examples provided above, or explore the insights from Culture and Climate Change project (http://www.cultureandclimatechange.co.uk/projects/) [Iryna Zamuruieva, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
65059	7	37	7	41	The bullet point can be misinterpreted and it is not obvious that a discussion of values and beliefs should be included in a scientific report. It can undermine the objectivity. [Magnus Joelsson, Sweden]	Not applicable. Section removed.
17447	7	37	7	41	It should be possible to rewrite these two sentences to make these points clearer and more relevant to policymakers, particularly focusing on the final part, '...the context for forming the messages can be accounted for.' [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
88885	7	37	7	41	I like to think that the WG1 physical sciences basis section is dealing with theory and observables of the physical climate system and that ultimately the outcome of the report is not based on values. This highly inappropriate statement should be removed. [Thorsten Mauritsen, Sweden]	Not applicable. Section removed.
111441	7	37	7	41	Nice to see this entry. [James Renwick, New Zealand]	Not applicable. Section removed.
131693	7	37	7	41	Looking at this key message from a practical point of view, I would like to know, what you are trying to say here. Is it that I need to understand the background, values and beliefs of those, constructing, communicating and receiving messages to improve climate communication or understand people's reactions? So far, your messages come out of the blue and does not explain, why I should know this. [Hans Poertner and WGII TSU, Germany]	Not applicable. Section removed.
104051	7	37	7	41	It seems a complicated way of saying that by including user requirements in construction of climate impact data, the usability has improved. [Philippe Tulkens, Belgium]	Not applicable. Section removed.
104053	7	37	7	41	A.3.3 is rather cryptic as currently phrased. E.g., including users in what phase(s)? [Philippe Tulkens, Belgium]	Not applicable. Section removed.
110983	7	37	7	41	This section is unclear - who are the "users" and what "context for forming the messaging" are we trying to account for? [Monica Dean, United States of America]	Not applicable. Section removed.
108183	7	37	7	41	This is a central concept for communicating the science of climate change, yet it is not explained clearly. [Anton Holland, Canada]	Not applicable. Section removed.
8093	7	37	7	41	It seems a complicated way of saying that by including user requirements in construction of climate impact data, the usability has improved. [Frank Dentener, Italy]	Not applicable. Section removed.
44709	7	37	7	41	A3.3. could be deleted. It states the obvious and does not say very much on top of that. It would also seem to be outside the scope in the already very long SPM. [Markku Rummukainen, Sweden]	Not applicable. Section removed.
104363	7	37	7	41	I suggest that this paragraph is deleted. If it is kept, you may need to add some text on what your values and beliefs are. [Finnveden Göran, Sweden]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
15033	7	37	7	41	Section A 3.3 is quite strange. What is being said? It should be clarified or omitted. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
42937	7	37	7	41	This paragraph is rather meaningless and obvious. It doesn't warrant inclusion as a top level conclusion. [Eric Wolff, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
20923	7	37	7	41	I do not understand why this section (A.3.3) is there. It is not clear what and to whom do we want to communicate. It is some how subjective. [Ladislau Chang#a, United Republic of Tanzania]	Not applicable. Section removed.
50119	7	37	7	41	In A3.3, please could you specify exactly what/which processes the users should be included in, in order to account for the context for forming the message. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
87249	7	37	7	41	The use of confidence levels in section A3.3 with respect to beliefs and communication weakens the WGI report. Actually we advise to skip section A3.3 as it doesn't contain scientific information on the physical basis. Moreover, the SPM is way too long. [Marcel Berk, Netherlands]	Not applicable. Section removed.
38895	7	37	7	41	I very much welcome the inclusion of paragraphs that address the communication of climate information and messaging in this SPM. However, limiting the "context" (as done in your first sentence) to "explicit values and beliefs" might fall a bit short. Practitioners, for example, may face very distinct requirements or constraints that cannot be considered as "values and beliefs". Climate information (or climate services) co-developed with practitioners aims to address exactly these requirements. So if this paragraph was written with this kind of - actionable, applicable - type of "climate information" in mind, my suggestion would be to address other elements of the "context" in the first sentence as well. What is being said about "values and beliefs" at the moment might apply to messages that convey certain information, but not necessarily with the aim to support decision-making and action. For this kind of (one-way) communication, it is good to tailor those messages to their target audiences. But members of the audience do not necessarily have to be engaged in the phrasing of the messages in my opinion. [Maike Nicolai, Germany]	Not applicable. Section removed.
132605	7	37	7	41	I'm not sure this is a message we want to lead off the SPM with. This section (A.3) feels a bit out of place in general. [Kyle Armour, United States of America]	Not applicable. Section removed.
129811	7	37	7	48	Storylines should be mentioned in A3.3 as a way to include users in the communication, as well as to provide context for climate information. [Trigg Talley, United States of America]	Not applicable. Section removed.
81215	7	37		40	Subsection A3.3 seems too general and do not reflect satisfactorily the results of 10.5 related to "co-design" and the role of including the users [Fatima Driouech, Morocco]	Not applicable. Section removed.
129813	7	38	7	38	Remove "belief". This could be viewed as another red flag. Recommended replacing with "expert interpretation of the data". [Trigg Talley, United States of America]	Not applicable. Section removed.
50123	7	38	7	40	users' - does this refer to any end user of the climate message, or specifically decision makers? It would strengthen the statement if you could clarify this please. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
129815	7	38	7	41	This key point is summarized better in Chapter 10. Adopt the language from Chapter 10. [Trigg Talley, United States of America]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9715	7	39	7	40	don't understand the final part of A.3.3. The start is clear, but what is meant by "by including users"? [Jonathan Lynn, Switzerland]	Not applicable. Section removed.
101537	7	39			Change "communicating and receiving" to "communicating, and receiving" [Knut Nadelhoffer, United States of America]	Not applicable. Section removed.
36069	7	39			This line makes some very serious assumptions that are unjustified: that one cannot avoid projecting ones values when casting IPCC language. It is not my 'values', but my experience and education and even nationality that may influence - but these are not my ethical or religious values. [Michael PRATHER, United States of America]	Not applicable. Section removed.
112151	7	40	7	40	Who are these mysterious users? This needs to be fleshed out somewhere - probably in the preamble text [Timothy Carter, Finland]	Not applicable. Section removed.
23341	7	40	7	40	The original formulation from CH10 ES is clearer and stronger: "There is high confidence that including users ensures the correct context in forming the message." [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed.
78651	7	40	7	40	"including users" - Who would these "users" be? Unclear! Please specify and also check the whole sentence - I did not get what was meant. [Heike Wex, Germany]	Not applicable. Section removed.
111443	7	40	7	40	I think we should have "messages" (plural) here, for consistency. [James Renwick, New Zealand]	Not applicable. Section removed.
87453	7	40	7	40	This formulation is not very meaningful: 'by including users, the context for forming the message can be accounted for'. As the paragraph notes (per chapter 1), the content of any 'climate message' is shaped by the values of those communicating (both sending and receiving). This means (1) not all users can be included (in what exactly?) and (2) the 'context' can NOT be accounted for -- since once the 'message' leaves the sender it is effectively free (what used to be called the 'death of the author'). Does the sentence want to say something like, 'the content of climate messages can be stabilised by incorporating the viewpoints of relevant users'? [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
25761	7	40	7	40	We suggest that "the context of forming the message" be replaced by "the context of forming, communicating and receiving the message" [Don Alfonso Pino Maeso, Spain]	Not applicable. Section removed.
69307	7	40	7	40	In the original sentence in Chapter 10, "ensured" is used instead of "accounted for". It would be better to adopt the same wording as the underlying chapter to avoid misunderstanding. [Kaoru Magosaki, Japan]	Not applicable. Section removed.
110781	7	40	7	40	"by including users" means? [cathy clerbaux, France]	Not applicable. Section removed.
109301	7	40	7	40	I cannot understand the meaning of this phrase: "by including users, the context for forming the message can be accounted for". Users of what? Accounting for what? "Context for forming the message"? Needs a complete rewrite. [Paul Edwards, United States of America]	Not applicable. Section removed.
23343	7	43	7	44	"The use of a narrative structure and storylines contributes to building a robust and comprehensive picture of climate information, and related risk." This sentence should be re formulated. The use of "climate information" is not correct because the purpose of storylines is not to have a robust and comprehensive picture of the climate information (this would be needed further up in the process of distilling the climate message), but rather of the climate change and/or variability. The sentence could be changed to for example "The use of a narrative structure and storylines contributes to building a robust and comprehensive message of climate change and variability, including related risk." [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111629	7	43	7	47	I agree with the paragraph but unfortunately there is no use of narrative/storyline approaches for LPHI events anywhere in the SPM. And certainly not in Box SPM.3. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
131695	7	43	7	48	The lack of a longer explanation of what the storyline approach is, makes it difficult to understand this key message. In communication storytelling is a very useful tool. However, I'm wondering what a storyline in climate risk communication is and what your advice actually means for stakeholders? What is your take-home message for your readers here? This might need some more explicit explanation or examples [Hans Poertner and WGII TSU, Germany]	Not applicable. Section removed.
83055	7	43	7	48	A.3.4. I think an important element of the storyline approach is that no a priori knowledge of the probability is assumed - or even needed. Perhaps the need for physically-based narratives to explore scenarios in the more general sense of the word "scenario" could be emphasised here? [Matthew Palmer, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
104055	7	43	7	48	A3.4 is correct, but it could also mention the risk of storylines- e.g. cherry picking, misintrepretation of extreme statistics in terms of likelihood, balanced view on risks. [Philippe Tulkens, Belgium]	Not applicable. Section removed.
86913	7	43	7	48	This para (A3.4) does not bring anything new compared to what is already written about storylines in Box SPM.1. Neither of the formulations describes what you actually mean with storylines, or explains the concept. Currently, it somehow just adds an addition term on top of scenarios and pathways, and can therefore easily create even more confusion in this already quite confusing realm. [Oyvind Christophersen, Norway]	Not applicable. Section removed.
108185	7	43	7	48	This is a central concept for communicating the science of climate change, yet it is not explained clearly, or with enough depth. [Anton Holland, Canada]	Not applicable. Section removed.
8095	7	43	7	48	A3.4 is correct, but it could also mention the risk of storylines- e.g. cherry picking, misintrepretation of extreme statistics in terms of likelihood, balanced view on risks. [Frank Dentener, Italy]	Not applicable. Section removed.
42935	7	43	7	48	I have now read 3 chapters including the framing one about storylines and I still have no idea what you mean. Either cut the jargon completely or explain it properly. Right now it reads like something you think is clever but can't describe. [Eric Wolff, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
4547	7	43	7	48	The usage of „narrative structure and storylines“ is questionable as it invites emotional framing of a subject that should stay entirely on the scientific side. Looking at the list of contributing authors of the AR6, there are a significant number of authors with links to environmental pressure groups and hardly any from the industrial sector. For years many the IPCC has struggled to find the right balance of authorship and unfortunately is far away from being a 360° referee panel. Allowing authors the usage of „narrative structure and storylines“ is a mistake. [Sebastian Luening, Switzerland]	Not applicable. Section removed.
87251	7	43	7	48	the terms "narrative" and "storylines" are not well defined (see glossary page 47). We advise to skip section A3.4 [Marcel Berk, Netherlands]	Accepted. This has been removed from the revised SPM.
36071	7	43			While I agree with A.3.4, there is also a very dangerous edge to this story telling. Storylines are inherently fiction and very different from most of the 'checked' facts going into WGI. They can be abused and help spread misinformation as easily as helping communicate climate science. storylines and narratives are what the USA alt-right uses all the time. [Michael PRATHER, United States of America]	Not applicable. Section removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111097	7	43			A.3.4 the storylines are good here but some of it reads like a research programme (shorten?) [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed.
9477	7	44	7	44	This statement should be consistent with statement in chapter 8's executive summary. We say that there is high confidence that human activities have altered the global water cycle since pre-industrial times. Suggest rephrasing line 44 to read: Human activities have affected the global water cycle since pre-industrial times (high confidence). [Joelle Joelle Gergis, Australia]	Not applicable. Section removed.
38897	7	44	7	44	Suggest to drop the "and related risk" (what kind of risk would be related to climate information?). [Maike Nicolai, Germany]	Not applicable. Section removed.
106061	7	44	7	46	As with my previous comment (P3, Lines 20-21), I suggest stating that these are physically plausible: "This can explicitly address physically plausible low-likelihood ..." [William Gutowski, United States of America]	Not applicable. Section removed.
81909	7	44	7	46	This reference to low-likelihood, high-impact events could be related to new material relating to the Covid-19 pandemic, if such material is included in the report. [Dan Zwartz, New Zealand]	Not applicable. Section removed.
101539	7	44			Change "information, and related" to "information and related" [Knute Nadelhoffer, United States of America]	Not applicable. Section removed.
69309	7	45	7	45	In Chapter 10, we find the same sentence without "potentially". It would be better to adopt the same wording as the underlying chapter. [Kaoru Magosaki, Japan]	Not applicable. Section removed.
25763	7	46	7	47	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
101541	7	47			Change "illustrating and communicating" to "illustrating, and communicating" [Knute Nadelhoffer, United States of America]	Not applicable. Section removed.
25765	7	48	7	48	Chapter 1.1.4 is referenced here but there is no 1.1.4 in Chapter 1. [Don Alfonso Pino Maeso, Spain]	Not applicable. Section removed.
116083	7		7		A3.2 refers to committed changes ("regardless of the emissions scenario"), but this is not true for all scenarios, all timescales (eg after 2050 in the case of ambitious mitigation). Please check. [Valerie Masson-Delmotte, France]	Accepted. Checked in HS6.1
65039	8	1	8	1	"Where are we now and how did we get here" to me is too anthropocentric. It is not like we fully control climate. What about: "The current state of climate and its past changes". [Johannes Quaas, Germany]	Taken into account. Changed to 'current state of the climate'
50125	8	1	8	1	"The Current State of the Climate" (without the second half) is clear, succinct and sufficient for a title. Suggest the rest is deleted. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
76951	8	1	8	19	The previous section highlighted the importance of integration of knowledge, for section be the energy balance (or imbalance) is the key integrating feature which can be better used to communicate the finding. This should start by a statement about this in the preamble which is then explored in this section. [Emer Griffin, Ireland]	Taken into account, framework and text clarified
76953	8	1	8	19	It is best to be consistent on the term that is used for the human impact on the energy transfers to and from the earth: energy budget, balance and imbalance is used. Perturbation of the energy imbalance is particularly obscure. [Emer Griffin, Ireland]	Taken into account. None of these terms appear in the revised SPM (except 'energy budget' in one of the footnote of the introduction). Instead, we now refer to energy gain/increase

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76955	8	1	8	19	The reader should be clear that the earth's energy balance has remained relatively stable over the last few millennia (most of recorded human history) but that balance has been changed over the century + by human activities. The consequences of this are apparent from climate records (observations and proxies). [Emer Griffin, Ireland]	Taken into account, framework and text clarified
97207	8	1	13	52	Please include in sections B.1 - B.4 information about the shift of climatic zones (temperature, precipitation, and with them ecosystems) in response to the observed global pattern. Such information could feed into the WG II report and is highly relevant for policy makers. [Nicole Wilke, Germany]	Taken into account. This section has been significantly shortened, reorganised and rewritten. HS1.8 now talks about the biosphere.
74655	8	1	14	46	In the section B on the current state and SPM as a whole, I miss a para on current trends in the land biosphere, in particular on the well-observed Earth greening and browning trends discussed in the chapter 2. Changes in vegetation do have a biophysical impact on climate (chapter 7) and C cycle (chapter 5). Earth greening, which might be not sustainable, is very visible and popular in the public debate on climate and I would highly recommend to mention it in SPM with traceable links to background processes explained in Ch2, 5, and 7. [Victor Brovkin, Germany]	Taken into account. This section has been significantly shorten, reorganised and rewritten. HS1.8 now talks about the biosphere.
104057	8	1	18	2	Similarly to subsection B3 regarding oceans, section B should contain a subsection dedicated to land. [Philippe Tulkens, Belgium]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore.
97209	8	1	18	2	To render the findings more meaningful, please provide quantified information wherever possible and also give percentages to increase understanding of the significance of the reported change. This concerns e.g. B1.5, B3.3, B3.5, B1.4, B.4.2, B.5.4, C.5.1. [Nicole Wilke, Germany]	Taken into account. Quantities have been added wherever possible.
38283	8	1	22	24	Part B, which assesses the factual observation of the climate system, is unbalanced in structure, with no assessment conclusions of the biosphere. Changes in vegetation/ecological conditions and their response to climate are important elements of interest to policy-makers, and land-air interaction is also an important process of climate variability. It is suggested to add assessments of biosphere in accordance with Chapter 2 in the underlying report. [Yaming LIU, China]	Taken into account. This section has been significantly shorten, reorganised and rewritten. HS1.8 now talks about the biosphere.
86915	8	1	38	18	Section B and C (see for instance page 25-28) mostly puts attention to large scale components in the climate system: energy imbalance, atmosphere, oceans, cryosphere. While the land and terrestrial components are almost entirely omitted e.g. soil moisture deficit is mentioned briefly, and land use is mentioned as a factor that can amplify or attenuate factors on the large scale. Obviously, there is a challenge to factor in the (changing) state of soils, land use, vegetation as the state and impacts must be assessed at the local level and resists aggregation. Please cooperate with the other WGs so these aspects are covered. We still think there is a need to supplement the perspectives on "large scale" components with perspectives on small-scale components from land and terrestrial domains, and since the SRCCL was already succesful in doing this there might be possibilities for the AR6 SPMs or in Technical Summaries. [Oyvind Christophersen, Norway]	Taken into account. Efforts have been made to increase land related topics in the SPM FGD. For example, figures SPM.3 and SPM.5 how climate variables related and of importance to land-related sectors. Regional / sub-large scale changes have been included in HS7 and HS11 of the spm.
44063	8	1			Section B is very informative and we appreciate the level of detail it provides. [Lamin Mai Touray, Gambia]	Noted with thanks.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89905	8	1			Trinidad and Tobago feels that section B as a whole is a very important part of the SPM as it contains all the key messages on impacts realized thus far, and which policy makers would want to take note of. It is our view that the section convey a clear narrative and should be enriched by being more focused, where possible. [Joanne Deoraj, Trinidad and Tobago]	Noted with thanks, we have tried to be more focused when revising the section.
87133	8	1			Section B contains a very comprehensive overview of the climate impacts to date and so while we are asking that the report be shortened we would ask that section B be retained because it provides very useful information that adds to the richness of the report. [Jacqueline Spence, Jamaica]	Noted with thanks.
78949	8	1			We think that it is important for policymakers to be informed about the dominant aspect of anthropogenic influences that changed the climate, ie. well-mixed greenhouse gases. This is only written in paragraphs B2.1 and B2.2. at the moment, we think that it deserves a sentence in a headline. We suggest the following headline statement : "global surface temperature increase since the mid-20th century is an established fact; the main driver of this warming is the increase in concentration of well-mixed greenhouse gases by human activities [appropriate uncertainty qualifier]". [Martine Vanderstraeten, Belgium]	Accepted. Human influence on the climate is now mentioned explicitly in the headline statement HS1.
66925	8	1			Perhaps I'm misunderstanding the structure, but shouldn't section B have a subsection for land? [Mathew Barlow, United States of America]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore.
99973	8	1			Section B provides a very comprehensive overview of climate impacts to date. While there is an overall need to shorten the SPM, it would be important to retain the richness and key elements of this section. [Caroline Eugene, Saint Lucia]	Noted. The SPM has been significantly shortened but the revised SPM has retained on the current state of the climate, largely building on the previous section B.
68795	8	1			Section B provides a very comprehensive overview of climate impacts to date. This is an important to retain. [Jeffers Cheryl, Saint Kitts and Nevis]	noted.
81959	8	2	8	10	This paragraph is the only text that refers to Fig SPM.3, but it makes no mention of the close similarity of "observed warming" and "net human influence" evident in the Figure. This would be a helpful addition to the SPM. [Dan Zwart, New Zealand]	Taken into account. HS1.2 now presents observed warming and human-caused net surface warming.
65525	8	2	8	10	Suggest strengthening discussion on the close similarity of "observed warming" and "net human influence" evident in Fig SPM.3. This paragraph is the only text that refers to the similarity. [Kushla Munro, Australia]	Taken into account. HS1.2 now presents observed warming and human-caused net surface warming.
54603	8	3	8	3	Preamble for section B: Subsection B2-B.5 all include both assessment of observed changes AND assessment of attribution. Please add to the preamble the information that sections in B include assessment of attribution in addition to assessment of the current state of the climate system. [Nancy Hamzawi, Canada]	Taken into account. Human influence/attribution now mentioned in the introduction of the section "state of the climate".
90741	8	3	8	3	Delete the word "Preamble" because it introduces an essential ambiguity in the SPM. For policymakers, the word Preamble in a document means that it is not an "operative" or "executive" part of the document, and therefore that it can be treated as a "nice to have" but not a necessary part of the document. On the other hand, SPM is, by definition, a document where every statement has a high scientific content and nothing is "preambular" in nature. All SPM is "operational" or "executive" and nothing is preambular. [José Romero, Switzerland]	Accepted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
5279	8	3	8	8	The preamble is distracting. [Daniel Murphy, United States of America]	Taken into account. Sections are now introduced with a short paragraph in italics, not in a box nor with the word 'preamble'
108187	8	3	8	9	"Proxy indicators of natural climate change" should be clearly explained to policymakers." [Anton Holland, Canada]	Taken into account. Proxy (which can be considered as jargon) is no longer mentioned in the revised SPM.
107783	8	3	8	14	Line 3, you write "PREAMBLE: Our understanding of the current state of the climate system is based on observations extending back to the mid-19th century" and line 13 you write "The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased since 1750 to levels unseen...." Do you mean that your understanding is based on observations that began in 1850 (mid-19th century) whereas you mention that the atmospheric concentration have begun one century before (1750) ? Is it a typing error or something different ? If so, it doesn't seem clear enough [FREDERIC MENARD, France]	Taken into account. We agree this was confusing and the introduction to the revised section on the state of the climate no longer includes the problematic sentence about the 19th century.
27737	8	4	8	4	Please use "climate proxy", or "climate indicator". "Proxy" on its own doesn't mean much if it is not known what is this proxy for. [Eric Brun, France]	Taken into account. Proxy (which can be considered as jargon) is no longer mentioned in the revised SPM.
36073	8	4			I would not use 'climate variability' here since that is used for recent decadal, how about "of the naturally changing climate" [Michael PRATHER, United States of America]	not applicable. The introduction of the section has been completely rewritten.
37419	8	5	8	5	Wrong. If understanding of climate systems is based on climate models then heaven help climate science. The reverse is how things are done - models are based on the level of scientific understanding of climate (sometimes good but sometimes merely assumptions or one or two unverified papers). [John McLean, Australia]	Noted.
129817	8	7	8	7	It sticks out that there is a mention of the atmosphere, ocean, and cryosphere, but not the land system. [Trigg Talley, United States of America]	Taken into account. The introduction of the section has been completely rewritten and no longer mentions the components of the climate but HS.1.8 is about the biosphere.
40517	8	7	8	7	Maybe include "land" and some key findings from SRCCL?? Particularly because the land is the part of global warming more quickly. [TSU WGI, France]	Taken into account. The introduction of the section has been completely rewritten and no longer mentions the components of the climate but HS.1.8 is about the biosphere.
112779	8	8	8	8	"hazards and impacts" should be "hazards, impacts and risks" (in WGII impacts are realised risks, potential future impacts are called risks) [Maarten van Aalst, Netherlands]	Not applicable. The introduction of the section has been completely rewritten and does not mention hazards anymore.
81823	8	8			Replace "are" with "is" such that the sentence reads: "It concludes with an assessment of extremes, which is particularly relevant to regional hazards and impacts" [Dan Zwart, New Zealand]	Not applicable. Sentence removed.
36075	8	8			drop 'regional' here, it is most often more local, and you do not need it. [Michael PRATHER, United States of America]	Not applicable. Sentence removed.
111631	8	11	8	11	This section does not discuss Earth's energy imbalance - only the changing radiative forcing agents and the associated ERF. This is a shame because quantifying Earth's energy imbalance is fundamental to understanding climate change and is actually an area where there has been good progress since AR5. There is strong material in the chapters on this and I think it would be helpful to summarise it in this section. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, framework and text clarified, now discussed more fully

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129821	8	11	8	11	The title of this section "Earth's Energy Imbalance" seems incorrect. A more accurate title would be "Radiative Forcing of Earth". This section does not discuss the physical reasons (ocean heat storage) or measurements of Earth's energy imbalance from CERES. [Trigg Talley, United States of America]	Taken into account. Radiative forcing and/or energy budget no longer features in the title of any section.
129823	8	11	8	11	"Energy Imbalance" is not a good title for the SPM. It's not clear if it's negative or positive, and how it relates to warming and other aspects of climate change. AR5 SPM reported radiative forcing of GHGs and stated explicitly that it's positive. [Trigg Talley, United States of America]	Not applicable. The only headings that we have retained are for the sections (A, B, C, D) we no longer use title for headline statements (A1, A2, A3 or HS1, HS2, HS3).
88887	8	11	8	11	This section contains no information on Earth's energy imbalance, only radiative forcing. I suggest changing the title to something like 'Drivers of global warming' [Thorsten Mauritsen, Sweden]	Taken into account. Radiative forcing and/or energy budget no longer features in the title of any section.
86917	8	11	8	11	In its current form this title gives an impression that section B.1 only deals with energy. However there are information in the associated bullets that presents finding that are relevant not only for the energy imbalance itself. Please consider to expand the title so that it better reflects some of the other features that are covered by the bullets, such as concentration in the atmosphere and emissions of GHGs. Maybe a more appropriate title could be "Imbalances in the climate system". [Oyvind Christophersen, Norway]	Accepted. Titles no longer given
108189	8	11	8	11	This entire subsection (B.1) is data heavy, and the concentration of numbers in the text makes it difficult for the average reader to consume. This information should be presented much more visually, or at least accompanied by clear visual information tools that complement the text. [Anton Holland, Canada]	Accepted. Text now simplified
132607	8	11	8	11	This section (B.1) would be better labeled "Drivers of climate change" or something like that. It doesn't discuss the Earth's energy imbalance at all. [Kyle Armour, United States of America]	Accepted. Titles no longer given
129819	8	11	9	31	Recommend Section B.1 be shortened by reducing the references to specific data and instead report general trends in the data. [Trigg Talley, United States of America]	Accepted. This and other sections of the SPM have been significantly reduced.
76845	8	11	9	31	SLCFs, which are covered in Chapter 6, should be referenced within this section. CH4 and aerosols are included, but more details should be provided as well as additional reference to Chapter 6. Both warming and cooling SLCFs are emitted alongside CO2, and as CO2 is reduced through efficiency and clean energy, there will be warming in the near-term from reduction in sulfates ("global brightening"). Xu Y. & Ramanathan V. (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Nat'l. Acad. Sci. 114(39):10315–10323 [Nathan Borgford-Parnell, Switzerland]	Taken into account. Figure SPM.2 b shows the effect of numerous SLCFs on temperature change.
26169	8	11	9	31	Section B1: As with previous Assessment Reports, a bar chart of global mean radiative forcing is required in SPM based on Figures 7.9 and 7.10. Changes in the energy balance are the most important fundamental parameters for understanding climate change. Changes in temperature and precipitation are secondary phenomena caused by changes in the energy balance. [Toshihiko Takemura, Japan]	Forcing can give a misleading picture of historical contribution to temperature. In an advance over AR5, emulators, calibrated to ERF and ECS estimates from Chapter 7, have been used to assess temperature change directly. This synthesis presenting the effect on surface temperature of emission changes associated to each primary compound is more informative for decision makers.
12641	8	11	9	31	This section B.1 is titled "Earth's energy imbalance", but it is all about radiative forcing. There should be at least three bullet points about (1). What is the assessment on the net earth's energy imbalance/uptake (2). The inventory of EEI (ocean/atmosphere/land/cryosphere heat uptake) (3) feedbacks [Lijing Cheng, China]	Taken into account, framework and text clarified, now discussed more fully

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
12647	8	11	9	31	Besides of the radiative forcing, feedbacks should also be provided, to be complete in the context of EEI [Lijing Cheng, China]	Accepted
68219	8	11	9	31	SLCFs, which are covered in Chapter 6, should be referenced within this section. CH4 and aerosols are included, but more details should be provided as well as additional reference to Chapter 6. Both warming and cooling SLCFs are emitted alongside CO2, and as CO2 is reduced through efficiency and clean energy, there will be warming in the near-term from reduction in sulfates (“global brightening”). Xu Y. & Ramanathan V. (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, PROC. NAT’L. ACAD. SCI. 114(39):10315–10323 (“Another complexity of the coemission issue is that a major part of the cooling aerosols (mostly sulfates and nitrates) is also coemitted by CO2-dedicated measures. Hence, the CO2 measures implemented in 2020 will unmask some of the aerosol cooling (red lines in SI Appendix, Fig. S5) and offset the warming reduction by CO2 and SLCP mitigation. In the baseline scenarios of this study, the cooling aerosols are regulated gradually between 2020 and 2100 (SI Appendix, Fig. S6), whereas in the mitigation scenario examined here, CO2 mitigation is implemented starting from 2020 and CO2 emission is brought to net zero in about three decades (SI Appendix, Fig. S2B). As a result, the unmasking of coemitted aerosol cooling (a net warming effect) is more rapid in the decreasing CO2 emissions beginning in 2020 (CN2020) mitigation scenario (SI Appendix, Fig. S5B vs. S7).”); Ramanathan V. & Feng Y. (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, PROC. NAT’L. ACAD. SCI. 105(38):14245–14250, 14245 (“The observed increase in the concentration of greenhouse gases (GHGs) since the preindustrial era has most likely committed the world to a warming of 2.4°C (1.4°C to 4.3°C) above the preindustrial surface temperatures. ...The estimated warming of 2.4°C is the equilibrium warming above preindustrial temperatures that the world will observe even if GHG concentrations are held fixed at their 2005 concentration levels but without any other anthropogenic forcing such as the cooling effect of aerosols. ...IPCC models suggest that 25% (0.6°C) of the committed warming has been realized as of	Rejected. This section for brevity takes an integrated approach
85883	8	11	9	31	The section B.1 on Earth's energy imbalance could be structured to improve the flow. In particular it could do with bringing information together as a more coherent story, rather than a list of facts. For instance linking the ERF, emission and concentration changes. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The structure of the SPM has been completely revised.
87163	8	11	9	31	Please consider to also include information about other regulated greenhouse gases such as the ones that are dealt with under the Montreal protocol (e.g. CFCs, HCFCs, HFCs). Information is available from the underlying chapter 6.2.2.9. [Oyvind Christophersen, Norway]	Rejected. This section for brevity takes an integrated approach

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68221	8	11	9	31	However, targeting SLCPs and reducing them quickly can result in near-term avoided warming, which is critical to slowing feedbacks and avoiding tipping points. There are strategies that specifically target SLCPs that will provide further benefits than what comes from SLCPs that are co-emitted with CO ₂ . See Shindell D., et al. (2012) Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security, Science 335:183–189, 183–184 (“Tropospheric ozone and black carbon (BC) contribute to both degraded air quality and global warming. We considered ~400 emission control measures to reduce these pollutants by using current technology and experience. We identified 14 measures targeting methane and BC emissions that reduce projected global mean warming ~0.5°C by 2050. This strategy avoids 0.7 to 4.7 million annual premature deaths from outdoor air pollution and increases annual crop yields by 30 to 135 million metric tons due to ozone reductions in 2030 and beyond. Benefits of methane emissions reductions are valued at \$700 to \$5000 per metric ton, which is well above typical marginal abatement costs (less than \$250). The selected controls target different sources and influence climate on shorter time scales than those of carbon dioxide–reduction measures. Implementing both substantially reduces the risks of crossing the 2°C threshold. ...The short atmospheric lifetime of these species allows a rapid climate response to emissions reductions. In contrast, CO ₂ has a very long atmospheric lifetime (hence, growing CO ₂ emissions will affect climate for centuries), so that the CO ₂ emissions reductions analyzed here hardly affect temperatures before 2040. The combination of CH ₄ and BC measures along with substantial CO ₂ emissions reductions [a 450 parts per million (ppm) scenario] has a high probability of limiting global mean warming to <2°C during the next 60 years, something that neither set of emissions reductions achieves on its own [which is consistent with (19)].”); UNEP & WMO (2011) Integrated Assessment of Black Carbon and Tropospheric Ozone; Xu and Ramanathan (2017) Well below 2 °C: Mitigation	Rejected. This section for brevity takes an integrated approach
85885	8	11	9	31	The ERF concept could do with more explanation as it might not be that familiar to policymakers. In particular I don't think it is explained anywhere in B.1 that increases in ERF are what lead to changes in temperature in B.2! [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We use the term "radiative forcing" in the Final Approved SPM for consistency with previous reports. The link between radiative forcing agents and temperature increase is made explicitly in Figures SPM.2 and SPM.4.
87165	8	11	9	31	It is highly relevant for policymakers knowing how large proportion of the anthropogenic CO ₂ emissions are taken up by terrestrial ecosystems and by the ocean. Thus, please consider including this information from Chp. 5, p6, l. 44-46. [Oyvind Christophersen, Norway]	Rejected as too detailed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68223	8	11	9	31	<p>Even though SLCPs avoid warming quickly (days to about a decade and a half), SLCP mitigation can have lasting benefits in 2100 and even 2200, plus avoids irreversible harm from sea-level rise. Shoemaker J. K., et al. (2013) What Role for Short-Lived Climate Pollutants in Mitigation Policy?, SCIENCE 342:1323–1324, 1323–1324 (“Direct comparisons of the climate influence of SLCPs and CO₂ require making a judgment about the relative importance of short and long time scales. SLCPs have a powerful impact on climate, but they persist in the atmosphere for only a short time—days to weeks for BC, a decade for CH₄, and about 15 years for some HFCs. Thus, immediate reductions in SLCPs will result in relatively immediate climate benefits, as the effects on climate depend largely on the emission rate, or flow, of SLCPs to the atmosphere. ...It is also important to recognize that CO₂ and SLCP emissions are not independent. Some of the steps to reduce CO₂ emissions will drive down emissions of SLCPs, as some of the largest sources of BC and methane are associated with fossil fuel production and combustion.”); see also Shoemaker J. K., et al. (2013) What Role for Short-Lived Climate Pollutants in Mitigation Policy?, SCIENCE 342:1323–1324, Figure (“Climate temperature response to reductions in emissions of CO₂, SLCPs, or both. Based on scenarios detailed in the supplemental material. Temperature change is shown relative to a pre-industrial baseline. In the Reference scenario, annual CO₂ emissions peak in 2080, after which they decline rapidly, while SLCP (CH₄, BC) emissions remain at or above current levels. In the “SLCP mitigation” scenario, deep cuts in BC (80%) and CH₄ (40%) emissions, relative to 2010 levels, are implemented linearly from 2010 to 2050. In the “CO₂ mitigation” scenario, CO₂ emissions are reduced by 20% relative to the reference scenario by 2050, followed by slowly decreasing emissions that intercept the reference scenario emissions at 2150. In this scenario, emissions of both BC and CH₄ are partially decreased relative to the reference scenario owing to those sources associated with fossil fuel consumption. The “HCM” scenario includes simultaneous</p>	Taken into account, mitigation of SLCP is discussed in SPM, Section 'Limiting climate change'

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68225	8	11	9	31	Could be helpful to reference the metrics covered in Chapter 7 here. Also, given the short lifetimes of SLCFs, a shorter timescale than 50 or 100 years—for example, using a metric like GWP20—would provide a better understanding of the near-term warming from SLCPs. This is important because many feedbacks and tipping points are anticipated within the next 10 to 20 years, as the 1.5°C guardrail is approached and likely breached. Masson-Delmotte V., et al. (eds.) (2018) SUMMARY FOR POLICYMAKERS, in IPCC (2018) GLOBAL WARMING OF 1.5 °C; Lenton T. M., et al. (2019) Climate tipping points—too risky to bet against, NATURE, Comment, 575:592–595; Steffen W., et al. (2018) Trajectories of the Earth System in the Anthropocene, PROC. NAT'L. ACAD. SCI. 115(33):8252–8259, 8254; and Drijfhout S., et al. (2015) Catalogue of abrupt shifts in Intergovernmental Panel on Climate Change climate models, PROC. NAT'L. ACAD. SCI. 112(43):E5777–E5786, E5784. GWP* being used throughout the AR6 Report can be a useful metric, but does not completely negate the need and utility of a metric for a shorter timescale like GWP20. In the IPCC 1.5C Report, GWP* is noted for its ability to describe the impacts from SLCFs, even providing a Figure in Cross-Chapter Box 2 that shows the differences between GWP100, GTP100, and GWP*. This does not help for shorter timescale concerns. In the First Order Draft for WGIII for AR6, GWP* is explained in Chapter 2 as allowing the comparison of a sustained change in emissions for non-CO2 forcings in comparison with CO2, but the chapter also notes that there are limitations to using GWP* for policy applications, including those relevant for the Paris Agreement (see WGIII FOD 2-23–2-24). Further, Chapter 2 does suggest that GWP20 may be useful alongside metrics like GWP100 and GTP100 to compare changes in emissions (WGIII FOD 2-22). In Chapter 6 of WGIII FOD, the authors note that a chosen climate metric and the time horizon for which it covers affect assessing the timing of achieving climate targets like net-zero emissions (WGIII FOD 6-100). In discussing the balance of CO2 and non-CO2 emissions from aviation, Chapter 10 of WGIII's FOD	Taken into account. Emission metrics covered in HS13.7
86919	8	11	9	31	In B1 there are plenty of references to results from AR5 and how the parameters have changed since then. This is very useful! If possible, it could preferably be included in all the B paragraphs, where relevant. [Oyvind Christophersen, Norway]	Noted
66719	8	11	9	31	SLCFs, which are covered in Chapter 6, should be referenced within this section. CH4 and aerosols are included, but more details should be provided as well as additional reference to Chapter 6, highlighting the breakdown of their contribution to warming (or cooling, in the case of some aerosols like sulfates). [Kristin Campbell, United States of America]	Accepted in part. SPM2 figure now details SLCF, but next takes and integrated approach

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66721	8	11	9	31	Could be helpful to reference the metrics covered in Chapter 7 here. Also, given the short lifetimes of SLCFs, a shorter timescale than 50 or 100 years—like using a metric like GWP20—would provide a better understanding of the near-term warming from SLCFs. GWP* being used throughout the AR6 Report can be a useful metric, but does not completely negate the need and utility of a metric for a shorter timescales like GWP20. In the IPCC 1.5C Report, GWP* is noted for its ability to describe the impacts from SLCFs, even providing a Figure in Cross-Chapter Box 2 that shows the differences between GWP100, GTP100, and GWP*. This does not help for shorter timescale concerns. In the First Order Draft for WGIII for AR6, GWP* is explained in Chapter 2 as allowing the comparison of a sustained change in emissions for non-CO2 forcings in comparison with CO2, but the chapter also notes that there are limitations to using GWP* for policy applications, including those relevant for the Paris Agreement (see WGIII FOD 2-23–2-24). Further, Chapter 2 does suggest that GWP20 may be useful alongside metrics like GWP100 and GTP100 to compare changes in emissions (WGIII FOD 2-22). In Chapter 6 of WGIII FOD, the authors note that a chosen climate metric and the time horizon for which it covers affect assessing the timing of achieving climate targets like net-zero emissions (WGIII FOD 6-100). In discussing the balance of CO2 and non-CO2 emissions from aviation, Chapter 10 of WGIII's FOD suggests that time horizon is a subjective choice of the whomever is using the information, and that if longer time horizons are chosen, CO2 becomes more important (WGIII FOD 10-51: "Any GWP/GTP type emissions equivalency calculation always involves the user selection of a time horizon, over which the calculation is made, which is a subjective choice (Fuglestad et al., 2010). In general, the longer the time horizon, the more important CO2 becomes in comparison with a SCLF [sic]."). [Kristin Campbell, United States of America]	Taken into account. Emission metrics covered in HS13.7
69311	8	11	9	31	Regarding the Section B1, as with previous Assessment Reports, a bar chart of the global mean radiative forcing would seem necessary in the SPM based on Figures 7.9 and 7.10, such as AR5/WG1 Figure SPM.5. Changes in the energy balance are one of the most important fundamental parameters for understanding climate change; changes in temperature and precipitation are phenomena caused by changes in the energy balance. [Kaoru Magosaki, Japan]	Rejected. Bar chart of temperature response has a stronger policy connection and is a key development from AR5
108239	8	11	9	31	This entire section is very well written and could be role model in its tangible statements in a necessary revision of Part A. [Johannes Quaas, Germany]	Noted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69849	8	11	9	31	This section could be improved by more explicit consideration of SLCF as covered in Chapter 6. Specifically that CO2 mitigation will unmask warming by reducing co-emission of cooling aerosols. Xu Y. & Ramanathan V. (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, PROC. NAT'L. ACAD. SCI. 114(39):10315–10323 ("Another complexity of the coemission issue is that a major part of the cooling aerosols (mostly sulfates and nitrates) is also coemitted by CO2-dedicated measures. Hence, the CO2 measures implemented in 2020 will unmask some of the aerosol cooling (red lines in SI Appendix, Fig. S5) and offset the warming reduction by CO2 and SLCP mitigation. In the baseline scenarios of this study, the cooling aerosols are regulated gradually between 2020 and 2100 (SI Appendix, Fig. S6), whereas in the mitigation scenario examined here, CO2 mitigation is implemented starting from 2020 and CO2 emission is brought to net zero in about three decades (SI Appendix, Fig. S2B). As a result, the unmasking of coemitted aerosol cooling (a net warming effect) is more rapid in the decreasing CO2 emissions beginning in 2020 (CN2020) mitigation scenario (SI Appendix, Fig. S5B vs. S7)."); Ramanathan V. & Feng Y. (2008) On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead, PROC. NAT'L. ACAD. SCI. 105(38):14245–14250, 14245 ("The observed increase in the concentration of greenhouse gases (GHGs) since the preindustrial era has most likely committed the world to a warming of 2.4°C (1.4°C to 4.3°C) above the preindustrial surface temperatures. ...The estimated warming of 2.4°C is the equilibrium warming above preindustrial temperatures that the world will observe even if GHG concentrations are held fixed at their 2005 concentration levels but without any other anthropogenic forcing such as the cooling effect of aerosols. ...IPCC models suggest that ≈25% (0.6°C) of the committed warming has been realized as of now. About 90% or more of the rest of the committed warming of 1.6°C will unfold during the 21st century, determined by the rate of the unmasking of the aerosol cooling effect, which is still uncertain but is likely to be of the order of a few decades").	Taken into account. SLCF shown in Figure SPM2, and its mitigation discussed in section 4 'limiting climate change'
54605	8	11			Section B.1: This section would benefit from deleting some of the very detailed technical information the importance of which will not be readily understood by policymakers (specific suggestions will be indicated at relevant line numbers). We recommend including information on the increase in energy in the Earth system given this is a robust indicator of a warming system. A conclusion from the AR5 that really resonated with policymakers and the public was the statement that over 90% of the excess energy in the climate system had been taken up by the ocean. Would recommend including such information again. Also, there is no mention of forcing from land use changes which is a gap vs previous WGI SPMs. This should be explained. [Nancy Hamzawi, Canada]	Accepted. HS4 is now much shorter than former B1 and HS4.2 mentions the 90% energy gain by the ocean.
27747	8	11			Section B.1 is complex and could be summarized by a figure. [Eric Brun, France]	Taken into account, framework and text clarified, now discussed more fully

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
85887	8	11			<p>Section B.1 is missing any discussion of emission metrics at all. This will be a key handover to WG III and it is essential to bring this up to the SPM. Some suggested text "Emissions metrics are useful for comparing the relative effects of different greenhouse gases, for example comparing the relative contributions of mitigation towards a climate policy target. AR5 discussed emission metrics such as GWP and GTP that compare the relative effects of pulse emissions of non-CO2 gases against CO2.</p> <p>Since AR5, alternative methods for comparing the warming effects of greenhouse gases have been developed. Step-pulse emissions metrics (e.g. GWP* and CGTP) compare the effects of a sustained step change in emissions of short-lived species like methane against a pulse emission of CO2. These give a more faithful simulation of the temperature effects of a portfolio of gases, especially under mitigation scenarios, such as those implied by successful attainment of the temperature goals set out in Article 2 of the Paris Agreement {7.6.3}." [William Collins, United Kingdom (of Great Britain and Northern Ireland)]</p>	Taken into account. Now covered in section 'limiting climate change'
93609	8	11			The title is inappropriate The text of this section is on the forcings. [Jean-Louis Dufresne, France]	Accepted. Titles no longer given
81411	8	13	8	14	Would be useful to give the percentage increases since 1750 after increased – i.e. add “by X%, Y% and Z% respectively” [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, this is provided in A2.1 of the final, approved SPM.
87323	8	13	8	14	add that concentration has increased by 46% since 1750 to 407 ppmv presently [Marcel Berk, Netherlands]	Taken into account. in the final (approved) SPM, concentration increases since 1750 are provided in A2.1.
129825	8	13	8	14	[PROGRESS] The new key finding "The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased since 1750 to levels unseen in at least 800,000 years (very high confidence)." is analogous to the AR5 WG1 SPM finding B.5 "The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years." Remove or update with the new insights. [Trigg Talley, United States of America]	Accepted. Text moved to HS2 and clarified
90169	8	13	8	16	The sentences "The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased since 1750 to levels unseen in at least 800,000 years (very high confidence). It is unequivocal that this increase is due to human activities. Current global carbon dioxide concentrations are unprecedented in at least the last 2 million years (high confidence)." seem to us to be one of the main messages coming out of the WG1 contribution to AR6 and need to stay. [Georges Gehl, Luxembourg]	Accepted. Text moved to HS2 and clarified
27739	8	13	8	16	The general idea of the first and the third sentence is the same. Could we consider for the sake of conciseness, avoiding such a duplication and keeping only one of them in the box? (and put the other one in B.1.1.) [Eric Brun, France]	Accepted. Text moved to HS2 and clarified
9717	8	13	8	18	don't understand the last part of B.1 "the perturbation to the.. Imbalance.. caused by human activity, quantified as ... is 2.53 Wm-2" does perturbation here mean the 2.53 is bigger/smaller than it would have been or is it an absolute figure. And cannot find the figure of 2.53 in B.1.5 or other subsequent paragraphs [Jonathan Lynn, Switzerland]	Taken into account. Text clarified
12643	8	13	8	19	Should expain what is EEI, and its relationship with forcing and feedbacks [Lijing Cheng, China]	Accepted. Language clarified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86921	8	13	8	19	Please consider to streamline this highlighted conclusion. We think the first two sentences could be merged together so that it reads "Due to human activities, the atmospheric concentrations of ... 800 000 years (very high confidence)". In addition, the findings regarding the proportion of CO2 emissions that stems from fossil fuel combustion and cement productions should be considered lifted to the highlighted conclusion. Maybe this information could be embedded in the third sentence somehow e.g. "Emissions from fossil fuel combustion and cement production were the main contributors (81-91%) to anthropogenic CO2 emissions over the period 2009-2018, and current global carbon dioxide ... 2 million years (high confidence)". Finally, you should consider if the last sentence is really necessary in the highlighted conclusion, especially since 2.53 Wm ⁻² is, frankly speaking, not a number that gives much to a policymaker without more specific information attached to it. [Oyvind Christophersen, Norway]	Accepted. Text moved to HS2 and clarified
76957	8	13	8	19	The key messages could start with a statement on the energy balance, how it has been changed and then address the drivers. [Emer Griffin, Ireland]	Taken into account. Text clarified
76959	8	13	8	19	perturbation of energy imbalance is unclear. [Emer Griffin, Ireland]	Taken into account. Text clarified
5281	8	13	8	19	A well-written red box with short, direct statements. [Daniel Murphy, United States of America]	Noted
107509	8	13	8	19	There is no clear Headline statement about the size of the human contribution to observed warming, as illustrated by Figure SPM.3 This headline statement (or another) should make the clear statement that "the best estimate is that human influence is responsible for all of the observed warming" (or some variant of that language.) This is critically important as the public (and thus policymakers) underestimate the human contribution to observed warming. [Hunter Cutting, United States of America]	Taken into account. Text clarified
16669	8	13	9	19	For the non-expert, the quoted forcing (2.53 W/m ²) might look as if it is only attributable to the carbon dioxide, methane and nitrous oxide mentioned in the first sentence. This would be clarified if "human activity" was expanded to "human activity including greenhouse gases and aerosols". [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, text clarified
50127	8	13	9	31	The term 'effective radiative forcing' may not be understood by a policymaker, could you please signpost to the Glossary for this definition or include as a footnote? It would also be helpful to provide some context to the RF values presented - for example, that positive numbers result in a warming while negative numbers result in a cooling should be explained. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. "Effective radiative forcing" does not appear in the revised version.
50129	8	13	9	31	It is not clear whether the ranges given throughout B1 relate to likely, possible, interquartile or some other type of range. It would be helpful to explain this as it could result in confusion, especially since the total CO2 emissions from fuel, cement and land use change do not add up to the same total as the accumulated, land and ocean CO2. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified
101543	8	13			Change "The atmospheric concentrations" to "Atmospheric concentrations" [Knut Nadelhoffer, United States of America]	Taken into account. Text clarified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
52231	8	14	8	14	unrevealed instead of unseen, because the ice core record of CO2 has only been partially deconvoluted (see my corresponding comment in chapter 5) [Dominique Raynaud, France]	Taken into account. Text clarified
129827	8	14	8	14	From a science communication perspective, it's important to provide context on the 800,000 years value. Modern-day humans have only been around 200,000 years, and humans 300,000 years. Therefore, the atmospheric concentrations are also levels that have never been experienced by modern-day humans. [Trigg Talley, United States of America]	Taken into account. Text clarified and moved to HS2
86085	8	14	8	14	Given what AR6 is aiming to achieve, it is advisable to use the strongest possible language that it still scientifically correct. "unequivocal" is a strong word, but does not communicate the point as clearly as for example conclusive, definitive, absolute, unquestionable, indisputable, irrefutable, unambiguous, unqualified. What is the best word for non-academics or people for whom English is not their first language? "cannot be explained without human induced warming" as in B.4.2 is also a very powerful yet simple way to say it. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text clarified and moved to HS2
27741	8	14	8	14	Please use the IPCC calibrated language along with or instead of "It is unequivocal". [Eric Brun, France]	Taken into account. "unequivocal" no longer features in the revised SPM. I should be noted, however, that no uncertainty language is required to describe findings for which evidence and understanding are so overwhelming that they can be considered as statements of fact.
87167	8	14	8	14	Please consider to find a better word than "unequivocal". It might be due to not having english as our mothertongue, but there must be better alternatives that are easier to understand. Word like "clear" or, less preferably, "undisputable" are alternatives that you could consider to help readers undertstand you message. [Oyvind Christophersen, Norway]	Taken into account. "unequivocal" no longer features in the revised SPM.
9481	8	14	8	15	Another extremely important statement that needs to be phrased more clearly. Suggest: It is indisputable that the post-industrial increase in key greenhouse gases is due to human activities. It supports the 'established fact' statement in A1 so should be worded more strongly. [Joelle Joelle Gergis, Australia]	Taken into account. Text clarified
129829	8	14	8	15	[PROGRESS] The key finding is not really new. The AR5 WG1 SPM key finding already has established it "Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions." Revise to communicate the new information or remove. [Trigg Talley, United States of America]	Taken into account. Text clarified and moved to HS2
37421	8	14	8	15	No it's not unequivocal at all. CO2 is emitted from oceans as they warm. [John McLean, Australia]	Rejected. Ocean and land are net carbon sinks, that means that absorb more CO2 than what they release (e.g. see HS8.1). More information can be found in the underlying chapter (5.2.1.3 and 5.4.2 / 5.4.4), which provides a detailed assessment of the gross uptake and release processes demonstrating that oceans are a net sink over the last few decades (Fig .5.8) and will continue to be one through much of 21st century (Fig 5.24-27).
76969	8	14	8	15	The unequivocal statement on human impacts is included in section A. The text in that section can be made cleared and then it does not need to be included here. [Emer Griffin, Ireland]	Accepted. Human influence on the climate is only mentioned in HS1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37423	8	15	8	16	An assertion made with high confidence? Beck showed plenty of instances of 19th century CO2 levels higher than today's. Further, it seems that you are assuming that you can simply concatenate two CO2 records from data in different locations derived by different methods. Surely even you know that this is an unscientific practice. [John McLean, Australia]	Rejected. Evidence is based on Chapter 2 assessment
86087	8	16	8	16	Suggest replacing the word “perturbation” with a simpler, more common, easier to understand word, e.g. disturbance, interference, disruption [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text clarified
26023	8	16	8	16	Please change “energy imbalance” by “energy balance” [Don Alfonso Pino Maeso, Spain]	Taken into account. Text clarified
91119	8	16	8	16	"The perturbation to the Earth's energy imbalance", should be "The perturbation to the Earth's energy balance", since the imbalance is a consequence of the perturbation of the energy balance. [Martin Wild, Switzerland]	Taken into account. Text clarified
65519	8	16	8	16	Suggest the text be changed to "the net perturbation to the Earth's energy budget", since the perturbation IS the imbalance to a system that [presumably] was previously in balance. [Kushla Munro, Australia]	Taken into account. Text clarified
12645	8	16	8	17	Why EEI should be quantified as effective radiative forcing (ERF) here in SPM?? It can be directly measured at top-of-atmosphere (we have satellites such as CERES), it can be much reliably quantified through ocean heat content plus land/atmosphere/cryosphere heat uptake. [Lijing Cheng, China]	Taken into account. The link between radiative forcing and the observed climate heating (Earth's energy imbalance) has been clarified in A4 in the Final Approved SPM.
130441	8	16	8	17	Section B is for the climate system changes but lacks component for biosphere. [Panmao Zhai, China]	Accepted. Biosphere details added
42351	8	16	8	18	This is a rather technical term to be included in Headline Box. Information in line 22-24 more clear and understandable. [Tina Christensen, Denmark]	Taken into account. Text clarified
25767	8	16	8	18	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
42201	8	16	8	18	B1 headline: Specify that the 2.53 Wm-2 is the sum of ERF from GHG and aerosol in 1.5 and 1.6 [Tina Christensen, Denmark]	Taken into account. Text clarified
37425	8	16	8	19	Wrong again. Your method of calculation ignores the fact that the wavelength bands in which absorption & scattering occurs with various anthropogenic GHGs and CO2 overlap with that from water vapour and that in many cases water vapour already absorbs and scatters 100% of the infrared radiation at those wavelengths. [John McLean, Australia]	Rejected. The literature this is based on is from comprehensive radiative transfer
81743	8	16	8	19	there is no under-point of B.1 for this statement/assessment outcome B1.1 to B1.7), and needs to be included. [Karina von Schuckmann, France]	Taken into account. Text clarified
104059	8	16	8	19	Please check consistency between the figures 2.53 (1.58 to 3.34) W.m-2 and 11% given in chapeau B.1 page SPM-8 lines 16-19 and the figures 3.63 (3.27 to 3.97) W.m-2 and 15 % given in B.1.5 page SPM-9 lines 9-11. [Philippe Tulkens, Belgium]	Accepted. Numbers checked and clarified
41227	8	17	8	17	2.53 W m-2: I think it needs to be made clearer that this includes the contribution of more than just the 3 gases discussed in the previous sentences. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified
77591	8	17	8	17	Section b.1.1 uses different comparative timeframes, eg 2009 - 2018, 2010 - 2018, not clear why didn't use a consistent time period. [Emer Griffin, Ireland]	Taken into account. Text clarified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90743	8	17	8	17	The use of the adjective "effective" in the expression "effective radiative forcing" is problematic. Indeed, in the Glossary, the definition of "effective radiative forcing" refers to that of "radiative forcing" and, again in the Glossary, "effective radiative forcing" is used only in relation to the radiative forcing of aerosols and clouds. [José Romero, Switzerland]	Accepted. "Effective radiative forcing" does not appear in the revised version.
8101	8	17	8	17	ozone depleteion=>stratospheric ozone depletion. [Frank Dentener, Italy]	Taken into account. Text clarified
112153	8	17	8	18	The effective radiative forcing shown here appears to be a sum of the GHG-induced ERF described in point B1.5, below and the aerosol-induced ERF described in B1.6, but this isn't acknowledged anywhere in the SPM. It would be helpful to explain the origin of the value of 2.53 Wm ⁻² . [Timothy Carter, Finland]	Taken into account. Text clarified
129831	8	17	8	18	An "is" is missing from this sentence. [Trigg Talley, United States of America]	Taken into account. Text clarified
129833	8	17	8	18	Text is too technical here. Recommend striking "is 2.53 (1.58 to 3.34) Wm ⁻² ". [Trigg Talley, United States of America]	Taken into account. Text clarified
17451	8	17	8	18	SPM-9, 9-11 seem to quote different figures. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified
39527	8	17	8	18	Based on infrared spectra of the atmosphere, http://dx.doi.org/10.1155/2013/503727 concludes to a radiative forcing of 2.6 W/m ² at doubled CO ₂ concentration. This finding, as well as infrared spectra which are missing in the entire report should be mentioned and discussed because they contradict the 2.58 W/m ² claimed whereas doubling is not achieved. [François Gervais, France]	Rejected. These don't refer to the same forcing
20339	8	17	8	18	It would be welcome to point out somewhere that this 2.53 Wm ⁻² imbalance matches exactly the contributions listed in B1.5 to B1. [philippe waldteufel, France]	Taken into account. Text clarified
97211	8	17	8	18	It is unclear how the ERF values stated here relate to those stated in B.1.5 through B.1.7, page 9. Possibly, an additional B.1.8 or a figure could clarify this. [Nicole Wilke, Germany]	Taken into account. Text clarified
97213	8	17			Please generally ensure that quantified information in statements in the highlighted summarizing paragraphs can be found in the underlying paragraphs. For example, the effective radiative forcing of 2.53 mentioned here can only be inferred to be the sum of the values given in B.1.5 and B.1.6. Clearly stating the fact that ERF from GHGs (B1.1.5) plus ERF from aerosols (B.1.6) yields total ERF in the highlighted paragraph makes it easier for the reader to put in context. [Nicole Wilke, Germany]	Taken into account. Text clarified
53461	8	17			Given the postponed release of the report, will it be possible to update all 2018 values with 2020 estimates? Could it be also feasible to compare the latest observed values with those predicted for/during CMIP5 just to highlight (in an implicit manner) that the median RCP scenario was not necessarily the most accurate? (although I'm not sure there was enough RCP spread in 2020 to check this) [Hervé Douville, France]	Taken into account. Text clarified and updated to 2019
86089	8	18	8	18	Please add "and xx% higher than pre-industrial level" [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted, this is provided in A2.1 of the final, approved SPM.
41291	8	18	8	18	Great work on highlighting assessment changes wrt AR5 in the headline statements throughout the SPM. If possible/feasible, please add this kind of information in all headline statements that are still missing AR5 comparisons. [Alexander Nauels, Germany]	Accepted, we have tried to do more of this wherever possible. Note however that we have also significantly shortened and simplified the headline statements. Therefore it wasn't always possible to include a comparison to AR5 in the headline statement.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9607	8	18	8	18	It would be useful to say here to attribute the 11% increase to their driving factors. [Olivier Boucher, France]	Taken into account. Text clarified
65521	8	18	8	18	Suggest clarification of the text: "... 11% higher than reported in AR5 for the year 2011." This is confusing since it includes two components: the retroactive revision of radiative forcing, and the increase in radiative forcing due to the continuing increase in GHGs since 2011. [Kushla Munro, Australia]	Taken into account. Text clarified
64787	8	22	8	22	It may be more accurate to describe atmospheric concentration as "the global average concentration." Given the seasonal variability which allows May 2018 to reach a little over 411 ppm, the qualifier that 407 ppm was the global average seems relevant. [Casey Kopcho, United States of America]	Taken into account. Space constraints preclude such detail in the SPM but it is available in the underlying report.
129835	8	22	8	22	The change in CO2 since AR5 should be 17 ppm (407.4 - 390.5) = 17 [Trigg Talley, United States of America]	Taken into account. Formulation simplified and comparison no longer carried
15427	8	22	8	22	Re: 407 ppm. According to the WMO Greenhouse Gas Bulletin 2019 (https://library.wmo.int/doc_num.php?explnum_id=10100), the atmospheric carbon dioxide concentration in 2018 was 407.8 ppm. It would become 408 ppm if rounding is considered. Please check and revise if appropriate. [SAI MING LEE, China]	Taken into account. Numbers updated. The WMO bulletin includes a number of sites which do not measure background levels and as such is precluded from the assessment per historical precedent.
27743	8	22	8	22	We recommend to clarify that the figure given is the average annual figure across the globe. [Eric Brun, France]	See 64787
37785	8	22	8	22	Please clarify whether the atmospheric concentration is 'global' or 'global mean'. [Junhee Lee, Republic of Korea]	Taken into account. Clarified in edits
110783	8	22	8	22	In 2018, the AVERAGED atmospheric concentration... [cathy clerbaux, France]	See 37785
50135	8	22	8	22	Will this statement be updated to include the average atmospheric CO2 concentration for 2019 in the next WGI draft? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Yes all figures updated wherever possible to do so.
101545	8	22	8	23	Change "In 2018, the atmospheric concentration of carbon dioxide (CO2) was 407 ppm, 15 ppm (or 3.8%) higher than reported in AR5 (2011) and 129 ppm (or 46.4%) higher than in 1750." [Knute Nadelhoffer, United States of America]	Taken into account. The sentence has been split apart and is now across HS.1 and HS.2 in a manner that avoids confusion for the reader
69315	8	22	8	23	In the same manner with the case of 1750, the phrasing "15 ppm higher than in 2011 (as reported in AR5)" is more understandable for readers. Otherwise, it could appear as if AR5 was published in 2011. [Kaoru Magosaki, Japan]	Taken into account. The 2011 comparison is now removed.
9719	8	22	8	28	does this add up ie is 5.5 10-20% of 40? (sorry rubbish maths) [Jonathan Lynn, Switzerland]	Noted. Text segment removed
31571	8	22	8	29	The quantification in this paragraph would be clearer if more homogenized: Total emission between 2009-2018 is given as a rate, emission from fossil fuel is not provided, and emission from land use and land use change is provided as a total for 2009-2018. Also, I understand that the stated 81-91% of all anthropo emssion attributed to fossil fuel and cement production is only valid for the period 2009-2018, but this is unclear as written. If the paragraph is only conceren about the last decade, it could be said more clearly, and so the distinction with the next paragraph would be made clearer. [Jean-Baptiste SALLEE, France]	Taken into account. The break down has been removed for simplicity and to avoid any conflicts with WGIII
86923	8	22	8	29	This section only quantifies the global emissions of CO2, please also quanified total global emissions from GHGs in CO2eq using GWP(100). Since the paris agreement is covering anthorpogenic emissions of GHGs and it uses GWP(100). [Oyvind Christophersen, Norway]	Rejected. This is the domain of WGIII and not WGI. Metric choices are detailed elsewhere where more appropriate in the context of remaining carbon budgets and emissions
69313	8	22	8	29	Basic information, such as a graph of the time series of the concentration of the major greenhouse gases is important and would be worth referencing the Figure TS.11 additionally inside the curly brackets. [Kaoru Magosaki, Japan]	Rejected. There is insufficient space for such an additional figure and there is such a figure in the TS and several such figures in the underlying report

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50131	8	22	8	29	Given that B1.1 refers to emissions 'reaching' a given level, it would be helpful to include the peak emission rate over the 2009-2018 period, not just the average, as this information will also be of interest to a policymaker. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. In reformulating the rate of emissions has been removed to avoid any potential conflict with other sections of the SPM as well as WGIII
117205	8	22	8	29	About average CO2 emissions over 2010 - 2018. Does make sense to calculate an average for a quantity that has increased over that period? Please also give the same info for fossil fuel emissions as for land use change emissions, have these also reduced their growth wrt previous decade? [Maisa Rojas, Chile]	Taken into account. This text has been removed from this segment
78261	8	22	8	34	If the intent is to say that "807 GtCO2 accumulated in land ecosystems means this amount is stored as sinks and carbon stocks", suggest it might be better to phrase it as "807 GtCO2 have been taken up in land ecosystems", as opposed to the accumulation of CO2 in the atmosphere. [Leonie Lee, Singapore]	Taken into account. Text clarified
78263	8	22	8	34	Suggest to also include the confidence level for B.1.1 and B.1.2. The way the rate of increase of CO2 concentration is framed compared to CH4 (B.1.3) differs quite significantly, e.g. ranges and confidence levels provided for CH4 but not CO2. [Leonie Lee, Singapore]	Taken into account. Text clarified
65061	8	22	8	37	Ranges seems to be written with a hyphen and not an en-dash [Magnus Joelsson, Sweden]	Taken into account. Text clarified
27745	8	22	8	37	Paragraphs B.1.1 and B.1.2 mix information on concentrations and anthropogenic emissions. It might be clearer to reorder: first sentence of B.1.1, along with information on the recent rate of rise of CO2 concentrations which is not referenced here (unlike CH4 in following paragraph); then B.1.2; finally the second part of B.1.1. [Eric Brun, France]	Taken into account. Text clarified
114925	8	22	8	46	All emissions estimates should be checked for consistency with the estimates from WG3 AR6 Chapter 2 to ensure consistency between WGs. The WG3 report is the primary place for the assessment of emission levels and trends. [Elmar Kriegler, Germany]	Accepted. Emissions no longer included
86925	8	22	9	31	The ERF from albedo (and other biogeophysical factors) deserves mention. Further, it seems most valid that ERF from albedo is accounted for in gross-gross figures, similar to practice where sources and sinks of CO2 are accounted for in gross figures. The reason is that any land use change that increases (gross) albedo, has this effect irrespective of other land use changes that reduce (gross) albedo. [Oyvind Christophersen, Norway]	Taken into account. Text clarified. Numbers presented in Figure SPM2
37427	8	23	8	23	Who measured CO2 in 1750? No-one. You have assumed that what is found from ice cores applies to the rest of the world but you have no evidence that the assumption is correct. [John McLean, Australia]	Rejected. Ice core measures have been proven to be representative of larger scales by numerous studies
26171	8	23	8	23	129 ppm higher than in 1750: Also describe an increasing rate. [Toshihiko Takemura, Japan]	Taken into account. The statement has been split apart and the since 1750 portion now stands in HS.2 where this has been further clarified.
90745	8	23	8	23	Write: " ... was driven by global emissions ..." [José Romero, Switzerland]	Taken into account. Similar formulation that suggested used in revised HS1.1
86927	8	23	8	24	Please consider including explicitly the annual emissions from 2018 in addition to the average over 2009-2018 period. This could maybe be done in an associated footnote. [Oyvind Christophersen, Norway]	Rejected. Emissions covered elsewhere in SPM and will also be covered in WGIII
76961	8	23	8	24	Does this increase refer to both periods? [Emer Griffin, Ireland]	Taken into account. Statement split across HS1 and HS2 to avoid ambiguity in interpretation

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76963	8	23	8	24	Separate recent emissions data from long term numbers e.g. a new sentence "Average CO2 emissions were x over the period from y to z" [Emer Griffin, Ireland]	Accepted. Findings now split across HS1 and HS2
69969	8	24	8	24	I would like to suggest that square bracket (AR5 used) is better to express uncertainty range than using round bracket, for instance, such like "40.3 [37.3~43.3] ". (I found many round brackets are used to represent uncertainty ranges after this line. I'd like to suggest it should be changed.) [Young-Hwa BYUN, Republic of Korea]	Noted. Use of brackets standardised throughout revised SPM draft
108235	8	24	8	24	I would find it useful to add to footnote #6 the notion: "1GtCO2 would be equivalent to 0.13 ppm if all CO2 would remain in the atmosphere." [Johannes Quaas, Germany]	Rejected. Text simplified and footnote not required
54609	8	24	8	26	A bit confusing as to whether the range in brackets on line 24 reflects uncertainty in the average or the changing values over the period refered to on line 26. [Nancy Hamzawi, Canada]	Taken into account. This text has been removed from this portion of the SPM
18709	8	25	8	25	Maybe better to explicitly specify the exact amount of CO2 emission from fossil fuel emissions and cement production, rather than percentage of the total from human activities. [Govindasamy Bala, India]	Taken into account. This text has been removed here as on balance t was felt to hinder rather than help. It was better handled elsewhere in the SPM in the context of RCBs or in WGIII
27749	8	25	8	25	The message for policy makers would likely be clearer, if possible, if fossil fuel combustion could be clearly singled out from cement production. [Eric Brun, France]	See 18709
37713	8	25	8	27	Currently the text says "Emissions from fossil fuel combustion and cement production, contributing 81-91% of all anthropogenic CO2 emissions, grew by 0.9% per year from 2010 to 2018, compared to 3.2% per year in the previous decade". The way this sentence is phrased suggests that emissions per year are decreasing in amount, from 3.2% to 0.9%. However, the previous sentence indicates that emissions have been increasing. This seems contradictory and should be checked and rephrased. [Stephanie Arcusa, United States of America]	See 18709
86929	8	25	8	27	Please consider to highlight the proportion from fossil fuel combustion and cement production (81-91%) by including this information in the B.1 highlighted conclusion. This could be embedded in the third sentence somehow e.g. "Emissions from fossil fuel combustion and cement production were the main contributors (81-91%) to anthropogenic CO2 emissions over the period 2009-2018, and current global carbon dioxide million years (high confidence)". Please also check the numbers, since in the executive summary in Chapter 5 (page 6 line 48-50) the 81-91% is only associated with fossile fuel combustion. Please make this consistent in the SPM and exe.sum Ch. 5. [Oyvind Christophersen, Norway]	See 18709
105635	8	25	8	27	What was the role of the global economic slowdown in the reduction in the growth rate of CO2 from 3.2% per year (2000-2009) to 0.9% per year (2010-2018)? [Julian Levy, United States of America]	See 18709

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64789	8	25	8	28	Recommend considering parallel language for how emissions from fossil fuel combustion/cement and land use is presented. Currently the language demonstrates the annual growth of fossil fuel combustion and cement relative to the past 2 decades; however, land use language simply states the remainder of emissions were 5.5 GtCO ₂ over the 2009-2018 period. It seems disjointed and may leave a reader curious as to what the growth rate of land use emissions was over the same time period. [Casey Kopcho, United States of America]	See 18709
104061	8	25	8	28	The presentation of the figures for fossil fuel combustion and cement production, and for land use and land use change, should be symmetrical: both should contain absolute figures in GtCO ₂ and average annual variation over 2010-2018. [Philippe Tulkens, Belgium]	See 18709
23349	8	26	8	26	Sorry for not having time to check in the main report - but this sounds perhaps to good to be true? 0.9% 2010-2018 and 3.2% for 2000-2009? [Anna Amelia Sörensson, Argentina]	See 18709
76965	8	26	8	26	Could the same period as the previous sentence be used? [Emer Griffin, Ireland]	See 18709
27751	8	26	8	27	This statement is a very important finding which deserves being reflected in the B1 Headbox. [Eric Brun, France]	See 18709
97215	8	26	8	27	Since the headline B.1 already points out, that the "CO ₂ concentrations are unprecedented in at least the last 2 million years", we suggest to add the following statement of the TS to the sub bullet B1.1: "the rate at which CO ₂ increased in the atmosphere during the Industrial Era has been at least 10 times higher than at any other time during the last 66 million years." (from TS-26 II33-34). This would add another valuable evidence on how unprecedented the observed changes in Earth's energy balance are. [Nicole Wilke, Germany]	Rejected. The redrafted HS2.1 hopefully makes the point more clearly despite lacking such explicit quantification
110785	8	26	8	28	why 2010 (line 26) and 2009 (line 28) [cathy clerbaux, France]	See 18709
80077	8	26	8	28	Anthropogenic CO ₂ should be shown from 2009 to 2018 instead of 2010 to stay coherent, also, include the change for the land use emission as well (e.g. grew by X% and per year?). [Lilian Fejes, Hungary]	Taken into account. Fewer distinct periods are now used throughout HS1
90747	8	27	8	27	Is forestry included in "Emissions from land use and land use change"? If it is not the case, please include it (cf. SRCCL). [José Romero, Switzerland]	See 18709
90889	8	27	8	28	Emissions from land use and land use change, responsible for the remainder of the anthropogenic emissions, were 5.5 (2.9 - 8.1) GtCO ₂ over 2009-2018. I suggest: "responsible for the remainder of the anthropogenic CO ₂ emissions" [Alvaro Zopatti, Argentina]	See 18709
18711	8	27	8	28	Has LULCC decreased compared to the previous decade? This may be discussed in a sentence. [Govindasamy Bala, India]	see 18709
27753	8	27	8	28	Could these emissions be compared to the number in the previous decade, as for emissions from fossil fuel combustion and cement production? [Eric Brun, France]	See 18709
42353	8	27	8	28	Would it be possible to compare numbers to previous decade like for CO ₂ emission from fossil fuel and cement production (line 26) [Tina Christensen, Denmark]	See 18709

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54441	8	27	8	28	Emissions from land use and land use change, responsible for the remainder of the anthropogenic emissions, were 5.5 (2.9 - 8.1) GtCO ₂ over 2009-2018. It should read: "responsible for the remainder of the anthropogenic CO ₂ emissions" [Maria del Pilar Bueno Rubial, Argentina]	See 18709
84699	8	27	8	28	what about emissions from land use and land use change for the decade before? This would add quantifying this contribution to the larger emissions documented for that period [Annalisa Cherchi, Italy]	See 18709
104063	8	27	8	29	"Emissions from land use and land use change, responsible for the remainder of the anthropogenic emissions, were 5.5 (2.9 - 8.1) GtCO ₂ over 2009-2018". It would be useful to compare with the previous decade, as done for fossil fuels combustion and cement production in lines 25 to 27. [Philippe Tulkens, Belgium]	See 18709
76967	8	27	8	29	Can actual % for land use emissions be included? Also be clear these are annual average values. [Emer Griffin, Ireland]	See 18709
97217	8	27	8	29	The main types of land use and land use change, which influence the global climate, should be mentioned at least once in the SPM, to make the term "land use change" more relatable for readers of the SPM. This incorporates e.g. the conversion of forests to pastures and cropland, the degradation of forests and the drainage of peatlands. [Nicole Wilke, Germany]	See 18709
14557	8	27	8	29	Express the numbers in this sentence also as % increases, to be consistent with the previous sentence? [Roshanka Ranasinghe, Netherlands]	See 18709
50141	8	27	8	29	In B1.1, for comparison it would be useful to also include the rate of emissions change from LULUC over the last two to decades, as is presented for emissions from fossil fuels combustion and cement production in lines 25-27. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See 18709
129837	8	27	8	31	How did this compare with the previous decade? Comparisons with the previous decade were given for other things in this paragraph. [Trigg Talley, United States of America]	Taken into account, text removed
86173	8	27			Give "the remainder" as a percentage as well to assist policy makers [Debra Roberts and the Durban WGII TSU, South Africa]	See 18709
129839	8	28	8	28	The unit GtCO ₂ appears incorrect here; should be GtCO ₂ yr-1. [Trigg Talley, United States of America]	See 18709
27755	8	28	8	28	Please clarify "anthropogenic emissions": use "anthropogenic CO ₂ emissions" [Eric Brun, France]	Taken into account. Clarified in revised HS1.1
104065	8	28	8	28	Clarify whether these are net emissions from LULUCF (sources-sinks), or gross emissions, and whether the estimate is consistent or not with the UNFCCC estimate of net carbon sources/sinks. (Grassi et al. 2018). [Philippe Tulkens, Belgium]	See 18709
9609	8	28	8	28	Change GtCO ₂ to GtCO ₂ yr-1 [Olivier Boucher, France]	See 18709
8097	8	28	8	28	Clarify whether these are net emissions from LULUCF (sources-sinks), or gross emissions, and whether the estimate is consistent or not with the UNFCCC estimate of net carbon sources/sinks. (Grassi et al. 2018). [Frank Dentener, Italy]	See 18709
69317	8	28	8	28	"GtCO ₂ " should be "GtCO ₂ yr-1". (cf. Chapter 5 - 5.2.1 - Table 5.1) [Kaoru Magsaki, Japan]	See 18709
10181	8	28	8	28	Gt CO ₂ /yr [Robert Kopp, United States of America]	See 18709
81825	8	28			Is the "5.5 (2.9 - 8.1) GtCO ₂ over 2009-2018" the total emissions over the period? The amount of emissions per year? Or what? [Dan Zwart, New Zealand]	See 18709

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36077	8	28			As I read this I want to hear about how the LULUCF emissions have changed over previous decade [Michael PRATHER, United States of America]	See 18709
81041	8	31	8	31	Between the sentence on the cumulative sink and the sentence on the efficiency of those sinks is declining, the paragraph needs a sentence that explains that the sinks are continuing to increase as CO2 continues to accumulate in the atmosphere. Often people read decline in efficiency with a declining sink in absolute terms which is not the case. [canadell pep, Australia]	accepted. the figure makes explicit that sinks increase in absolute terms but decrease in fractional terms
25769	8	31	8	32	We suggest to add in brackets as an explanation to land use change ("e.g. deforestation, forest degradation and peat drainage"). [Don Alfonso Pino Maeso, Spain]	taken into account. the figure caption explains where land use data are obtained. discussion of the processes is in chapter 5
129841	8	31	8	34	The cumulative total CO2 emission (fossil fuel/cement and land use emissions (1613 + 862 = 2475 GtCO2)) and the CO2 reservoirs (Atmosphere (1008) + Ocean (623) + Land ecosystems (807) = 2438 GtCO2) do not sum to the same value. Where does the discrepancy lie? On line 33 the [] should be (). [Trigg Talley, United States of America]	taken into account - final numbers have been checked and corrected
129843	8	31	8	34	The numbers for reported cumulative land and ocean fluxes are not in the Chapter 5 Executive Summary. Section 5.2.1.5 reports similar quantities in C units not in CO2 units based on the latest GCP budget (Friedlingstein et al., 2019). Assessment of land and ocean sinks will benefit from including more than one line of evidence -- i.e., GCP modeling estimates. There are also CMIP6 historical and other MIPs' simulations of land and ocean C fluxes. For example, the ESM-based ocean carbon estimates are shown to be consistent with observations after a similar to GCP ocean model adjustment -- e.g., Bronselaer, B., M. Winton, J. Russell, C. L. Sabine, and S. Khatiwala (2017), Agreement of CMIP5 simulated and observed ocean anthropogenic CO2 uptake, Geophysical Research Letters, 44(24), 12,298-12,305. [Trigg Talley, United States of America]	taken into account. the section has been revised and the final numbers used now are taken from the TS and traceable back to chapter 5.
104067	8	31	8	34	The discrepancy between the sum of sources (2475 GtCO2) and sum of sinks + atmospheric accumulation (2438 GtCO2) should be explained. [Philippe Tulkens, Belgium]	taken into account - final numbers have been checked and corrected
97219	8	31	8	36	Provide the contribution of the sinks also in percentages please. [Nicole Wilke, Germany]	accepted. the new figure shows sink fractions
87169	8	31	8	37	This paragraph states that fossil fuel combustion and cement production emitted 1613 GtCO2 while land-use change emitted 862 GtCO2. This is a total of 2475 GtCO2. The paragraph then states that, of the cumulative total CO2 emissions, 1008 GtCO2 have accumulated in the atmosphere, 623 have been taken up by the ocean and 807 have accumulated in land ecosystems. However, this still leaves 37 GtCO2 unaccounted for (2475-1008-623-807=37). Perhaps the excess is due to the margins or error, but it should nonetheless be explained. [Oyvind Christophersen, Norway]	taken into account - final numbers have been checked and corrected
87171	8	31	8	37	It is highly relevant for policymakers knowing the risk of the land and the oceans switching from being a sink to a source. Thus, please include information from Chp. 5, p. 7, l. 32-36. [Oyvind Christophersen, Norway]	accepted. a new figure has been introduced which shows the continued uptake but declining fraction under different scenarios
104069	8	31	8	37	This paragraph is clear and policy-relevant, and should be retained in future versions. [Philippe Tulkens, Belgium]	accepted
76971	8	31	8	37	These are really important numbers. Great to see them provided? A statement on these in the headline message is needed [Emer Griffin, Ireland]	taken into account. we created a new figure to give greater prominence to them

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
76973	8	31	8	37	The weakening of natural sinks is an important message for policy. It should be in the headline [Emer Griffin, Ireland]	accepted. this is now explicit in the new figure heading
81911	8	31	8	37	Be clear if coastal wetlands (blue carbon) are included in the figures for "ocean" or "land" sinks or if they are absent from calculations. I note that this is more explicit in the detailed report (e.g. 5.29/Rows 1-2) but some practitioners will only take quotes from the summary document so it needs to be clear. [Dan Zwartz, New Zealand]	taken into account. the revised text does not quote sink estimates in order to be concise
27757	8	31	8	46	The use of pourcentage in this two paragraphs would clarify the message. [Eric Brun, France]	Taken into account. Text clarified
101547	8	31			Change "emitted 1613 (1540-1687) GtCO ₂ " to "emitted 1613 (1540-1687) GtCO ₂ ," [Knut Nadelhoffer, United States of America]	accepted.
54607	8	32	8	32	Please include the total cumulative carbon emissions from 1750-2018 along with uncertainties. Policy-makers will want this information and will want to know how the uncertainties in the individual estimates should be combined. [Nancy Hamzawi, Canada]	accepted. total emissions are presented in table SPM.2
90749	8	32	8	32	Is it only "land-use change" or does it include land use and forestry? If it is not the case, include it (Cf. SRCCL). [José Romero, Switzerland]	accepted. it includes land use and forestry as well. text and figure labels have been clarified
104071	8	32	8	32	It is unclear what "cumulative total CO ₂ emissions" refers to. Is it only the sum of the previously mentioned terms (fossil, cement and LUC), or also other emissions (e.g., land use not involving LUC, like from the management and degradation of forests and soils) and whether it is gross or net. If appropriate, it would be preferable to say "cumulative net anthropogenic CO ₂ emissions". [Philippe Tulkens, Belgium]	accepted. the text has been corrected - it did not mean to imply only land-use change
41229	8	32	8	34	I wonder if it would be clearer to state these values as percentages of the total emissions, rather than (or as well as) the absolute quantities. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	accepted. the new figure shows sink fractions
18713	8	32	8	34	Maybe better to also quote the % of emissions that has accumulated in the atmosphere and %s that have been taken up by land and oceans. [Govindasamy Bala, India]	accepted. the new figure shows sink fractions
25771	8	32	8	34	We would suggest to also use percentages when explaining the different contributions of atmosphere, oceans and land. [Don Alfonso Pino Maeso, Spain]	accepted. the new figure shows sink fractions
36079	8	32			Do you want a "net" on LULUCF emissions, since forest regrowth (rare but some LULUCF) cancels out the total 'emissions'? [Michael PRATHER, United States of America]	taken into account. The term is a net of two gross components, but we chose not to explicitly use the word "net" as simply "land use emissions" is in common usage
101549	8	33			Change "[990-1027] GtCO ₂ " to "(990-1027) GtCO ₂ " [Knut Nadelhoffer, United States of America]	accepted
104073	8	34	8	36	"There is high confidence that the fraction of excess anthropogenic CO ₂ removed by ocean and land has declined, consistent with the expectation that emerging feedbacks will weaken these sinks". This is very important and may require further clarification in the SPM: why the carbon sink has declined? Is it linked with deforestation, urbanisation, biodiversity loss and similar anthropogenic issues? What does "emerging feedbacks" means in this sentence? [Philippe Tulkens, Belgium]	taken into account. the text has been revised and restructured so that this paragraph does not appear in this form. Figure 7 replaces it and shows changes in the sink amounts and fractions
9721	8	34	8	36	the last part of B.1.2 sounds like v important new material to be highlighted [Jonathan Lynn, Switzerland]	taken into account. a new figure has been introduced which highlights how this continues in the future

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86561	8	34	8	37	I don't think the high confidence in declining carbon sinks is correct. Section 5.2.1 in chapter 5 only gives medium confidence (I see chapter 5 exec summary says high confidence, but that also seems wrong) . Sink rates are declining but the airborne fraction is not increasing, clearly showing that this is complicated (rate of CO2 increase matters, as does decadal variability) and we don't fully understand yet what's driving these trends (or lack of trends). [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	taken into account. text structure has been altered, and is consistent with chapter assessment
129845	8	34	8	37	[CONFIDENCE] The wording of the SPM message ("...the fraction of excess anthropogenic CO2 removed by ocean and land has declined...") is confusing since it introduces a finding based on the new since AR5 metric, "sink rate" (5.1.1.2), while previous assessment used "airborne fraction", which remains constant since 1959. Consider revising message by using "uptake rate" or "sink rate" and introduce a footnote defining the metric. Confidence in the sink rate declining is overinflated: (1) in the SPM and in the Chapter 5 Executive Summary, it has high confidence, but in 5.1.1.2 it has medium confidence; (2) Section 5.1.1.2 gives medium confidence to the sink rate decline based on two studies (Raupach et al., 2014, Bennedsen et al., 2019). The medium confidence in 5.1.1.2 is given based not on the number of studies or agreement between them but on the physical reasoning, which is not how confidence levels are assessed in the IPCC. Based on the two studies with high agreement confidence would be low. Frölicher et al. (2013) do not provide evidence on sink rate trends. Still, decline in land and ocean sink uptake efficiencies could be an important message. Perhaps chapter authors can look for more evidence in published literature to support this finding. [Trigg Talley, United States of America]	taken into account. text structure has been altered, and is consistent with chapter assessment
23351	8	34	8	37	Confidence statement repeated. [Anna Amelia Sörensson, Argentina]	accepted - text has been corrected
86091	8	34	8	37	Consider providing a quantitative estimate of the decline [Debra Roberts and the Durban WGII TSU, South Africa]	taken into account. text structure has been altered, and is consistent with chapter assessment
129847	8	35	8	35	The word "excess" is inappropriate. It conveys the wrong message then requires a definition. Recommend just saying "the fraction of anthropogenic CO2 emissions..." instead. [Trigg Talley, United States of America]	accepted. "excess" no longer used
9611	8	35	8	35	I've never been a big fan of measuring feedbacks on the airborne fraction, which is a pretty ill-defined quantity. Can you say which feedbacks? If vegetation stops taking up CO2 because there are other limiting factors (eg nitrogen), is this a feedback? [Olivier Boucher, France]	accepted. The discussion of processes affecting the fractions are given more detail in the TS. SPM changes in airborne fraction and land/ocean fraction are now shown in figure 7 but not using the same phrasing of feedbacks
104075	8	35	8	35	declined over which period and by how much? Which feedbacks, and why would that only apply to the future (will)? [Philippe Tulkens, Belgium]	taken into account. a new figure has been introduced which highlights how this continues in the future
8099	8	35	8	35	declined over which period and by how much? Which feedbacks, and why would that only apply to the future (will)? [Frank Dentener, Italy]	taken into account. a new figure has been introduced which highlights how this continues in the future
111633	8	35	8	36	P 12 L 33 seems to suggest that the ocean uptake strength hasn't changed. These two sentences need to be consistent. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	accepted. revised text has been made consistent
104077	8	35	8	37	It would be useful to give a quantitative indication of the increase of the airborne fraction. [Philippe Tulkens, Belgium]	taken into account. we introduce a new figure which shows explicitly changes in airborne (and land and ocean) fractions

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108541	8	35	8	37	Inconsistent with the FAQ 5.1 see lines 8-9 specifically. Also check lines 48-51 of Chapter 5 pg 28 and figure 5.3 [Jason Donev, Canada]	taken into account. wording and structure revised to prevent confusion between the constant fraction of airborne emissions over the past 60 years (now mentioned in SPM as well as FAQ 5.1) and the change in the cumulative sink fraction (now explained in SPM, TS, and Ch. 5)
36081	8	35			"excess" is a bit jargon, how about emitted? Even as an insider, I am not sure how to calculate excess without a definition. [Michael PRATHER, United States of America]	accepted. "excess" no longer used
132609	8	36	8	36	This wording is a bit confusing. I think it is the weakening of these sinks that we consider to be carbon cycle feedbacks, so it can't be said that "feedbacks will weaken these sinks". [Kyle Armour, United States of America]	taken into account. wording and structure revised
25773	8	36	8	36	The concept of "feedbacks" could be explained the first time it appears in the text. [Don Alfonso Pino Maeso, Spain]	taken into account. wording and structure revised
69319	8	36	8	36	It would be informative for readers to add what “emerging feedbacks” means. [Kaoru Magosaki, Japan]	taken into account. wording and structure revised
78605	8	36			I disagree that declining sink efficiency is due to climate feedbacks. Emissions no longer rising exponentially would be enough on its own to cause this. Climate feedbacks are possible too, but secondary. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	accepted. Text has been revised to be more explicit under what circumstances the cumulative sink fraction declines, indicating that cumulative emissions as well as carbon cycle feedbacks in scenarios with larger climate change affect the change
36083	8	36			again, language: "weaken the effectiveness of these sinks" , since the magnitude of these sinks will continue to increase. [Michael PRATHER, United States of America]	accepted. the new figure shows sink fractions decreasing as well as magnitudes increasing
78149	8	37	46	39	The breakdown between fossil and biogenic methane sources should be provided (it is in SRL) aslo new data on these emissions e.g. Z ref Should be included. [Emer Griffin, Ireland]	taken into account. this paragraph no longer exists in revised structure
25777	8	39	8	41	It is mentioned that the period of reduced growth ended in 2007, but it does not state when that period started. According to chapter 5 page 31 lines 2-3, it started in the late 90s. This piece of information could also be included. [Don Alfonso Pino Maeso, Spain]	Taken into account. This text has been removed here and consolidated with text under HS13 and HS14
83017	8	39	8	42	Suggest adding {5.2.2} to the line of sight, for the material on CH4 [Dan Zwartz, New Zealand]	See 129849
86933	8	39	8	42	Please consider to also describe and quantify sinks for methane, similar to CO2 in B.1.2. You might want to include figures 5.12, 5.14 and 5.17 in the SPM, or at least in the TS, to present visually both carbon, methane and nitrous oxide budgets equally. [Oyvind Christophersen, Norway]	Not applicable. The text for CO2 has been removed
37429	8	39	8	46	All your talk about CH4 and N2O is pointless because the wavelengths at which they absorb and scatter infrared energy are dominated by water vapour and CO2, which in most cases already absorb and scatter 100% of the infrared energy. Further, you fail to take the amount of energy at each wavelength into account. I refer you to the simple summary image at https://commons.wikimedia.org/wiki/File:Atmospheric_Transmission.png . [John McLean, Australia]	Rejected. The assessment is based upon substantive review of the literature performed across multiple chapters.
12099	8	39	8	46	The citation to the main section needs to be better assinged (B.1.2 for CO2 needs only section 5.2.1 & section 5.2.2 for CH4 should be given in B.1.3 . Here, is there any chance to include the global budget numbers for CH4 and N2O as well? [Prabir Patra, Japan]	See 129849

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34401	8	39	8	46	If this statement is only based on emissions activity trends (and does not consider the outstanding question of why the methane trends slowed and then accelerated), then the discussion of emission estimates and trends should be separated or the outstanding question of the role of emissions variability (e.g. from wetlands) should be summarized. [Haroon Kheshgi, United States of America]	See 129849
27759	8	39	8	46	It might be preferable to separate the treatment of methane and N ₂ O. Clarify also that as a short-lived climate forcer the impact of methane follows more the evolution of emissions [Eric Brun, France]	Noted. The text has been removed from the draft
50133	8	39	8	46	Across B1.1 and B1.3, the atmospheric concentration increase in emissions of greenhouse gases are all given differently, making them difficult to compare - for atmospheric concentrations, CO ₂ is given an absolute change between 2011 and 2018, CH ₄ is given as an average rate over 2009-2018 and N ₂ O is given as an average rate since the 1990s; for emissions, CO ₂ is given in Gt per year over 2009-2018, CH ₄ is not given at all, and N ₂ O is given a percentage change since the 1980s. It would be helpful to standardise this and provide comparable figures for these changes. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text has been substantively streamlined and many of the numbers and periods have been dropped for comprehensibility
117207	8	39	8	46	Reading this text (and previous paragraph B1.2) it is hard to follow what exactly is happening to these 3 GHG, except that they are increasing. Is it possible to use common timeframes? (to the extent possible). [Maisa Rojas, Chile]	See 50133
67809	8	39	8	46	Potential and trends from methane gas emission (CH ₄) from landfills as the third largest methane gas emitter should be added in this chapter. This is in line with the increase in population number, urbanization, and consequently increase in municipal solid waste and human activities. https://www.epa.gov/lmop/basic-information-about-landfill-gas https://www.eesi.org/papers/view/fact-sheet-landfill-methane [Ruandha Agung Sugardiman, Indonesia]	Not applicable. Text has been removed in redraft and consolidated with HS13 and HS14
129849	8	39	8	47	Authors specifically state that emissions from fossil fuels and livestock are responsible for the increased rate of atmospheric methane concentration since 2009; however, it is then important to directly add here the evidence/confidence in the statement that permafrost thaw and related methane emissions have not contributed substantially to the increased methane. It is important to specifically call out permafrost thaw, because policymakers will be looking for it. [Trigg Talley, United States of America]	Noted. This text has been removed and the discussion of methane has been consolidated in HS13 and HS14. The discussion of different sources has been removed from the SPM draft.
86931	8	39	8	47	Would it be possible to include the percentage increase in methane concentration since pre-industrial time in this paragraph? Or mention explicitly the pre-industrial level of the methane concentration, not only the present day concentration and recent rate. The same is also relevant for the N ₂ O concentration. [Oyvind Christophersen, Norway]	Noted. Space constraints preclude such detail but text has been reformulated for clarity under HS2.1
69321	8	39	9	7	Aerosols and ozone are grouped in B.1.4 while CH ₄ and N ₂ O are grouped in B.1.3. The criteria for this grouping (e.g. perhaps the life time) should be clearly stated. [Kaoru Magosaki, Japan]	Taken into account. Text clarified
76975	8	39	46	37	The breakdown between fossil and biogenic methane sources should be provided (it is in SRL) as new data on these emissions e.g. Z ref should be included. [Emer Griffin, Ireland]	Noted. Space constraints preclude such an addition

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129851	8	40	8	41	Methane "resumed long-term growth" after period of reduced growth does not make sense if it was continually growing (if just at a reduced rate). Text should be clarified. [Trigg Talley, United States of America]	Not applicable. Text has been removed in redraft and consolidated with HS13 and HS14. Aspects under the purview of WGIII have been removed in entirety to avoid any overlap.
86093	8	40	8	41	The sub-phrase "resuming its long-term growth following a period of reduced growth that ended in 2007" is a sub-argument that confuses the main message of the first sentence. It should be moved to a separate sentence: "The period x-x saw a temporary slow-down of methane emissions, but since 2007 the upward trend has resumed, largely driven by ..." [Debra Roberts and the Durban WGII TSU, South Africa]	See 129851
25775	8	40	8	41	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
97221	8	40			Please add information about how long the period of low CH ₄ concentration growth was. [Nicole Wilke, Germany]	See 129851
15429	8	41	8	41	Re: 1859 ppb. According to the WMO Greenhouse Gas Bulletin 2019 (https://library.wmo.int/doc_num.php?explnum_id=10100), the atmospheric methane concentration in 2018 was 1869 ppb. Please check and revise if appropriate. [SAI MING LEE, China]	Rejected. As per precedence the WMO numbers which include a number of unrepresentative sites have been excluded
129853	8	41	8	42	[CONFIDENCE] Medium confidence in livestock/fossil fuel sources as a driver of atmospheric methane growth is not strongly supported by the evidence (and confidences) provided in Chapter 5. Authors need to expand B.1.3 to address sinks of methane and associated confidences. [Trigg Talley, United States of America]	See 129851
90751	8	41	8	42	Regarding the growth in CH ₄ since 2007, it would be informative to provide the part of the emissions from fossil fuels and the one from livestock [José Romero, Switzerland]	See 129851
25779	8	41	8	42	Rice cultivation and landfills should also be mentioned as sources of CH ₄ emissions (see chapter 5, page 30, lines 40-41). [Don Alfonso Pino Maeso, Spain]	See 129851
65523	8	41	8	42	Suggest changing the text to "... was largely driven by emissions from fossil fuel production and livestock..." This will clarify that this was not fossil fuel combustion. [Kushla Munro, Australia]	See 129851
34397	8	42	8	42	As written the statement is unclear. One could interpret this as meaning that most of the increased growth is due to growth in FF and livestock emissions, or one could interpret this as meaning that FF and livestock remain a source of methane (which is not new). Suggest that this statement be clarified or deleted. [Haroon Kheshgi, United States of America]	See 129851

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104379	8	42	8	42	The category "fossil fuels" should be expanded to clarify that the production of oil, gas, and coal all are significant contributors. Mitigation strategies for each of these sources is very different, thus policy makers need to understand that all three sources are contributors. The mitigation of emissions from the production of oil and gas offers particularly valuable opportunities as nearly all of that can be done at zero net cost - either through the elimination of leaks and venting or the substitution of other fuels for power generation and electrification of end uses in the building sector. See submitted comments on Chapter 5 which provides numerous new references not discussed in Chapter 5 that identify the production of oil and gas as a major contributor to the renewed growth in CH ₄ since 2007. [Hunter Cutting, United States of America]	See 129851
107977	8	42	8	42	should "There is medium confidence that the growth in CH ₄ since 2007 was largely driven by emissions from fossil fuels and livestock." really say "There is medium confidence that the growth in CH ₄ since 2007 was largely driven by INCREASES in emissions from fossil fuels and livestock." After all these emissions were already occurring before 2007, so need to be clear what changed to cause the renewed growth in CH ₄ abundance. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	See 129851
76977	8	42	46	46	The information on N ₂ O could be included in a separate para. The same type of information should be provided for each of the main GHGs [Emer Griffin, Ireland]	See 129851
50137	8	43	8	43	"since the 1990s" is used as the baseline for nitrous oxide increase but this is quite vague, please could you specify the year or if the statement corresponds to early/mid/late 90s? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See 129851
78653	8	44	8	44	"Agricultural NO ₂ emissions" - Annual??? Or before 1980 is to after? This should be stated. [Heike Wex, Germany]	See 129851
131697	8	44	8	46	B1.3 - increased 30% from what? What proportion/amount of the N ₂ O concentration is from agriculture [Hans Poertner and WGII TSU, Germany]	See 129851
25781	8	45	8	45	In chapter 5 page 38 lines 40-42 a figure other than 30% is provided: "Agricultural N ₂ O emissions have increased by approximately 80% since the early 1900s (Davidson, 2009), and by more than 45% since the 1980s (robust evidence, high agreement) (Figure 5.16)" [Don Alfonso Pino Maeso, Spain]	Noted. Text has been removed from draft of SPM.
129855	8	46	8	46	[CONFIDENCE] B.1.3 reports high confidence in 70% increase during 1980-2016 in nitrous oxide emissions from fertilizer use and manure, with Section 5.2.3 supporting this estimate with one submitted manuscript (Tian et al., submitted 2019) while noting large uncertainties in the methods used to arrive at such emission estimates. It's not clear if one study (compiling multiple but uncertain emission estimates) provides sufficient evidence to justify high confidence in the reported number, especially with no uncertainty range given. [Trigg Talley, United States of America]	Noted. Text has been removed from draft of SPM.
27761	8	46	8	46	Add the reference "5.2.2" for methane. [Eric Brun, France]	Not applicable. Text removed
50139	8	footnote	8	footnote	Would it be possible to clarify in the footnote that 1Gt = 1 billion tonnes? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. We believe that 'giga' is a common term, especially given that has now become a frequent computer term.
116085	8		8		B1.2 please quantify the decline in the fraction of CO ₂ removed by the ocean and land sink. [Valerie Masson-Delmotte, France]	Accepted. Quantity provided in HS8.1

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
116087	8		8		B1.6 the stabilisation of the aerosol forcing in the last decades, and thus the fact that it has a reduced effect on the RF trend due to increases in GHG concentrations should be made more explicit in the HS B1. [Valerie Masson-Delmotte, France]	Taken into account in the final version. A.4.1. now says "The radiative forcing has increased by 0.43W m ⁻² (19%) relative to AR5, of which 0.34 W m ⁻² is due to the increase in GHG concentrations since 2011. The remainder is due to improved scientific understanding and changes in the assessment of aerosol forcing, which include decreases in concentration and improvement in its calculation (high confidence)."
4097	8		22		highlighted some observed changes in the climate systems (atmosphere, cryosphere, ocean), should include the biosphere? It is an important climate indicator also vital component. Generally readers and policymaker would find of interests. [Daoyi Gong, China]	Accepted. Biosphere is now mentioned in HS1.8.
86095	9	1	9	1	This paragraph it is confusing because it reads like stratospheric ozone is the same as aerosols (which it isn't). Aerosols need to be defined (e.g. dust, smoke, ...), an explanation why this is so would be helpful. Consider moving ozone to a separate, short paragraph. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
69323	9	1	9	1	The footnote 7 for Aerosol optical depth (AOD) in B.1.4 would seem to fit better in the Glossary to supplement the current information. The explanation for AOD may need to be rephrased, as the current statement may be difficult to understand at first glance for policymakers. [Kaoru Magosaki, Japan]	Accepted. AOD no longer mentioned in the revised version.
109303	9	1	9	1	I'm glad to see the footnote explaining AOD. Please add something about the meaning of a "decrease"/increase in AOD, since this is not obvious from the definition of the term. Also, there's a grammar issue in the footnote and it does not appear to be finished. [Paul Edwards, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
65529	9	1	9	1	Suggest explaining the term 'aerosol optical depth' for readers who may not be familiar with it. [Kushla Munro, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
23353	9	1	9	2	Suggestion to change to "mid-latitude continents" or "Northern and Southern Hemisphere mid-latitude continents"? [Anna Amelia Sörensson, Argentina]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
41231	9	1	9	3	The non-quantitative nature of first sentence contrasts unhelpfully with the quantitative second and third sentences. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
26173	9	1	9	3	A changing rate of global and/or regional mean aerosol optical depth should be described. [Toshihiko Takemura, Japan]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
108543	9	1	9	4	This idea of aerosol optical depth should be explained in the glossary as well as the footnote 7. [Jason Donev, Canada]	Taken into account. Aerosol optical depth was seen as too technical and is no longer mentioned in the revised version,
9723	9	1	9	6	is this a good or a bad development? Needs a line to explain [Jonathan Lynn, Switzerland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
89647	9	1	9	7	B.1.4 needs an assessment of global mean AOD changes as well. [Trude Storelvmo, Norway]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129857	9	1	9	7	Why are aerosol optical depth, tropospheric ozone, and stratospheric ozone trends all placed into one bullet? One would think that AOD trends were related to stratospheric ozone trends, which they are not. [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

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12101	9	1	9	7	..., the O3 increases seem to be in the similar ballpark for all the sub-hemispheres. Do we see similar increase in OH in all these latitude bands? This probably is a science question to the community! [Prabir Patra, Japan]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54611	9	1	9	7	This paragraph could be deleted. Policy-makers will not be interested in these details. Space could be given to other more relevant information (see general comment on this section). The information on changes in aerosol levels could be integrated into the paragraph about aerosol forcing (space permitting). [Nancy Hamzawi, Canada]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
27763	9	1	9	7	This paragraph is very technical, and the link to climate change is unclear. We suggest to delete it, in order to shorten the SPM. [Eric Brun, France]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
69325	9	1	9	7	It would be useful for readers to add reasons why aerosol optical depth and stratospheric/tropospheric ozone has decreased. It is unclear whether these changes are associated with human activity or natural variability of climate system. [Kaoru Magosaki, Japan]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
29393	9	1	9	7	This passage needs review in terms of a more detailed explanation of the link between AOD and ozone decline. [Joachim Fallmann, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
117209	9	1	9	7	About stratospheric ozone, can you say more explicitly what has happened over the last 2 decades? [Maisa Rojas, Chile]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
42203	9	1	9	7	B1.4: Why are aerosols and ozone combined here. Consider using less technical term than "aerosol optical depth", since the statement is general. This would also avoid the use of a footnote (footnote 7). [Tina Christensen, Denmark]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76979	9	1	9	9	How well is a reduction in aerosol optical depth known to policy? This is very obscure and the message for policy is not evident. [Emer Griffin, Ireland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76981	9	1	9	9	The interactions between air quality and climate policy are very important. This is not apparent from the is section which is very obscure in its formulation. The partial success of air quality policy has implications for climate with ground level ozone being a key GHG. [Emer Griffin, Ireland]	Taken into account. The final section of the revised SPM now explicitly talks about air quality.
76983	9	1	9	9	some reference to the radiative forcing of PM and ground level ozone could be included. [Emer Griffin, Ireland]	Not applicable. bullet point B1.4 removed from revised SPM and B1.5 refocused, to shorten the SPM and focus on what matters most to policy-makers.
42015	9	1	9	31	Paragraph B 1.4 to B 1.7 include important information but is written in very technical manner including uncertainty ranges. Would it be possible to simplify the text, however, the information on uncertainties is important to capture. For example, the text could also indicate the best-estimate ERF values, with the uncertainty ranges given in a table. [Juhani Damski, Finland]	Taken into account. Text clarified and simplified
65063	9	1	9	31	Ranges seems to be written with a hyphen and not an en-dash [Magnus Joelsson, Sweden]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
104079	9	1	9	31	B1.4-B1.7. These statements are far too technical for a non-expert reader. They need to be simplified and contextualised. [Philippe Tulkens, Belgium]	Taken into account. The content covered by those bullet points is now explained in much simpler terms in the revised SPM. (For instance the term 'ERF' no longer appears and the term 'radiative' is only featuring twice).

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1899	9	1			You have to explicitly exclude the episodic impacts of volcanic eruptions from this statement about aerosols optical depth. [Alan Robock, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
93615	9	1			in note 7, “the amount of sunlight blocked by aerosol” is not correct, “the amount of sunlight scattered or absorbed by aerosol” is probably better [Jean-Louis Dufresne, France]	Not applicable. bullet point + footnote removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111099	9	1			B.1.4 this is a very short timeline for aerosols wouldn't it be good to expand on the increase prior to that etc? [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50145	9	2	9	2	Observed changes in aerosol optical depth - please could you clarify if, based on the regional trends reported in B1.4, whether this corresponds to a net increase or decrease in aerosol optical depth globally. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
114927	9	2	9	3	For the lay reader it is not a very impressive statement if things are as likely as not (which will be understood as could be either way). This is not so, but maybe there are better ways to say that the past decade was very warm by holocene standards. [Elmar Kriegler, Germany]	Taken into account. HS2.2 now frames it as unprecedented warming in at least the last 2000 years.
8105	9	2	9	10	An additional sentence is needed explaining why it is relevant to know how long ago in the past temperature was as high as now. When was the end of the last interglacial maximum? How can that climate state and the current one be compared? [Frank Dentener, Italy]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129859	9	3	9	4	What about at higher latitudes, where the ozone hole is most prominent? [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25783	9	3	9	4	Please clarify whether the 2.2% decline refers to 1980 or to 1964-1980, as stated in chapter 2, page 23 lines 9-12 : "Near-global 2014-2017 mean total ozone was about 2.2% below the pre-ozone depletion 1964–1980 average (Braesicke et al., 2018). At southern and northern mid-latitudes, declines, related to anthropogenic ODSs, are 5.5% and 3.0% below the 1964–1980 average respectively" [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
78957	9	3	9	7	We do not understand the message here, in the framework of a SPM. It is about observations of stratospheric and tropospheric ozone, but what does it mean? We do not see the policy relevance and there is no link with the title of the section: we suggest deleting [Martine Vanderstraeten, Belgium]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
97223	9	3			Please add the fact that stratospheric ozone did not fully recover in recent years. [Nicole Wilke, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
44711	9	4	9	6	It is unclear over which periods the percentages apply. Decadal? Over some period? Which periods? A clarification would be useful. [Markku Rummukainen, Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25785	9	4	9	6	Please consider whether "northern mid latitudes" should be replaced by "most regions of northern latitudes" and "tropics" by "sampled regions of northern and southern tropics" as stated in chapter 2, page 25, lines 23-26: "Since the mid-1990s, free tropospheric ozone has increased by 2-7 % per decade in most regions of the northern mid-latitudes, and 12 % in the sampled regions of the northern and southern tropics (high confidence). Ozone increases in southern mid-latitudes were less than 5 % (medium confidence)". [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27793	9	4	9	43	Concerning the footnote 7, we think its formulation to be incorrect. It should be rephrase like this: "A measure of the amount of sunlight blocked by aerosols, related to the amount of aerosols in the vertical column of atmosphere". [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36085	9	6			I know you may have to say it, but to give such a large range for trop ozone increase (2-12%) and say it has high confidence seems bizarre. If I said -10% to +20%, we could say 'almost certain'? [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
69327	9	7	9	7	Please revise the reference from 6.2.1 to 6.2.2. [Kaoru Magosaki, Japan]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
129861	9	8	9	8	This section is on Earth's Energy Imbalance. It makes sense to include the observational discussion of Earth Energy imbalance here. [Trigg Talley, United States of America]	Not applicable, in the revised SPM there is no longer a section solely focusing on the earth's energy imbalance.
37431	9	9	9	9	Who measured CO2 in 1750? No-one. You have assumed that what is found from ice cores applies to the rest of the world but you have no evidence that the assumption is correct. [John McLean, Australia]	Rejected. There is strong evidence from ice cores in different locations and other evidence
86097	9	9	9	9	In this bullet the numbers are not so easy to interpret. What about including a % of total warming due to each of these gases? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text clarified and simplified
90753	9	9	9	9	The use of the adjective "effective" in the expression "effective radiative forcing" is problematic. Indeed, in the Glossary, the definition of "effective radiative forcing" refers to that of "radiative forcing" and, again in the Glossary, "effective radiative forcing" is used only in relation to the radiative forcing of aerosols and clouds. [José Romero, Switzerland]	Accepted. "Effective radiative forcing" does not appear in the revised version.
110787	9	9	9	9	footnote to explain what effective radiative forcing means? [cathy clerbaux, France]	Taken into account. Text clarified and simplified
50147	9	9	9	9	Suggested edit: 'The total effective radiative forcing (ERF) from increases in all greenhouse gases...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
90891	9	9	9	10	What has been expressed at the top of page 8 (lines 16-18) that reads "The perturbation to the Earth's energy imbalance caused by human activity, quantified as effective radiative forcing for 2018 relative to 1750, is 2.53 (1.58 to 3.34) Wm-2, 11% higher than that reported in AR5 for the year 2011". Is more or less confused in relation to these lines. [Alvaro Zopatti, Argentina]	Taken into account. Text clarified and simplified
54443	9	9	9	10	This lines are confusing in relation to the expressed at the top of page 8 (lines 16-18) that reads "The perturbation to the Earth's energy imbalance caused by human activity, quantified as effective radiative forcing for 2018 relative to 1750, is 2.53 (1.58 to 3.34) Wm-2, 11% higher than that reported in AR5 for the year 2011". [Maria del Pilar Bueno Rubial, Argentina]	Taken into account. Text clarified and simplified
129865	9	9	9	11	Here authors mention the changes in ERF due to increased emissions since AR5 and the revisions in the ERF calculations -- raising the question, how much of the change in ERF is due to additional emissions versus a refinement of the ERF calculation? [Trigg Talley, United States of America]	Taken into account. Text clarified and simplified
104081	9	9	9	11	Please check consistency between the figures 2.53 (1.58 to 3.34) W.m-2 and 11% given in chapeau B.1 page SPM-8 lines 16-19 and the figures 3.63 (3.27 to 3.97) W.m-2 and 15 % given in B.1.5 page SPM-9 lines 9-11. [Philippe Tulkens, Belgium]	Taken into account. Text clarified and simplified

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26029	9	9	9	11	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
69329	9	9	9	11	In comparing the total ERF estimates between AR5 (in 2011) and AR6, it could be useful to isolate the effect of concentration increase from the methodology revision and include it, if possible, in a footnote. [Kaoru Magosaki, Japan]	Taken into account. Text clarified and simplified
65527	9	9	9	11	Suggest clarifying the text for policymakers, the media and other non-science readers: "...15 % greater than the 2011 estimate in AR5..." Suggest that the text should state the relative contributions of actual increased radiative forcing versus upward revision of radiative forcing. [Kushla Munro, Australia]	Taken into account. Text clarified and simplified
34967	9	9	9	17	The SOD puts an upward revision of the short-wave forcing of Methane (CH ₄) since AR5. Please see rebuttal comment #4 above. [Jim O'Brien, Ireland]	Taken into account. Text clarified and simplified
76985	9	9	9	17	The change in radiative forcing is one of the most important calculations provided. For this to be clear the concept of RF or EFR should be explained in clear language earlier e.g. by linking it to text on the global energy balance. This would make these data more accessible. [Emer Griffin, Ireland]	Taken into account. Text clarified and simplified
76987	9	9	9	17	Can revisions to forcing estimates be explained for each gas? [Emer Griffin, Ireland]	Taken into account. Text clarified and simplified
97225	9	9	9	17	If the expression "revision for forcing estimates" indicates a change in the methodology with respect to AR5, please explain, and quantify the changes in the estimates. Provide the contribution of the individual GHG also in percentages please. [Nicole Wilke, Germany]	Taken into account. Text clarified and simplified
42355	9	9	9	25	B1.5 - 1.6 seems rather technical with many numbers included. Could conclusion be done more in a narrative way? Numbers could go in table. [Tina Christensen, Denmark]	Taken into account. Text clarified and simplified
15035	9	9	9	31	Example of 'précis' vs 'summary'. Policymakers find concepts like total effective radiative forcing difficult. Its use is fine in the main chapters but here (and elsewhere in the SPM) more user-friendly language would be better. The red boxes are a rather clumsy way of trying to achieve the same thing; they should be dropped in favour of a comprehensive re-write. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
69331	9	9	9	31	Most of the exact values of ERF throughout B.1.5-1.7 may be too technical for policy makers and could be replaced with percentages relative to the total ERF of 3.63 Wm ⁻² . [Kaoru Magosaki, Japan]	Taken into account. Text clarified and simplified
42205	9	9	9	31	B1.5-1.7: Could ERF numbers go into a table. Combine with Figure SPM3? [Tina Christensen, Denmark]	Taken into account. Text clarified and simplified
129863	9	9			In B.1.5, for clarity, add " from increases in greenhouse gases alone...". The reason is that the difference in effective radiative forcing cited here compared to that cited in the section's overarching summary (SPM-8, Line 17) is at first confusing. [Trigg Talley, United States of America]	Taken into account. Text clarified and simplified
36087	9	9			from' => 'due to' ? with 'from' in the dates/ [Michael PRATHER, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
27765	9	10	9	10	The figure in the headbox B.1 is 2.53W.m ² and 11%. Either the same figures should be presented here, or the difference should be made more explicit for the reader. [Eric Brun, France]	Taken into account. Text clarified and simplified

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37787	9	10	9	10	In line 8 of p.8, it is written as '11% higher', but here it is written as '15% greater'. It seems that the values should match. [Junhee Lee, Republic of Korea]	Taken into account. Text clarified and simplified
88889	9	10	9	11	I recommend providing a split of the 15 percent into the two sources. [Thorsten Mauritsen, Sweden]	Taken into account. Text clarified and simplified
129867	9	10	9	11	This sentence mentions that the forcing estimate is 15% greater than in 2011 (since AR5) due to increases in atmospheric concentrations and revisions to the forcing estimates. It would be very useful to know the relative contributions of each. [Trigg Talley, United States of America]	Taken into account. Text clarified and simplified
10861	9	10	9	11	And changes to the how Effective Radiative Forcing is defined (e.g., land temperature adjustment). [Gareth S Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
44713	9	10	9	11	How much is due to which factor? [Markku Rummukainen, Sweden]	Taken into account. Text clarified and simplified
39529	9	11	9	12	Based on infrared spectra of the atmosphere, http://dx.doi.org/10.1155/2013/503727 concludes to a radiative forcing of 2.6 W/m ² at doubled CO ₂ concentration. This finding should be mentioned and discussed because they contradict the 2.15 W/m ² claimed for CO ₂ whereas doubling is far from being achieved. [François Gervais, France]	Rejected. The paper and text talk about different things
36089	9	11			revisions in calculating the forcing. [Michael PRATHER, United States of America]	Taken into account. Text clarified and simplified
65065	9	12	9	12	The estimated effective radiative forcing of CH ₄ has almost halved since AR5. This could be commented on, especially as the atmospheric concentration has gone up. [Magnus Joelsson, Sweden]	Taken into account. Text clarified and simplified
26337	9	12	9	13	W m ⁻² -> power is a different font [María Santolaria-Otín, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
27767	9	12	9	14	Percentage corresponding to each single figure is required to help policymakers to better understand this point. [Eric Brun, France]	Taken into account. Text clarified and simplified
76989	9	12	9	15	Numbers should be included for what is termed the remainder. [Emer Griffin, Ireland]	Taken into account. Text clarified and simplified
76991	9	12	9	16	Shortwave radiative forcing has been revised upwards, can this be explained in clear terms? Is this essential information for the SPM, if so why? [Emer Griffin, Ireland]	Taken into account. Text clarified and simplified
36091	9	12			This is technically wrong as written. The CH ₄ numbers must also include the ozone and stratospheric water vapor ERF since the "increase" in CH ₄ directly lead to those changes. This is not an 'emission-driven' effect (as for CO, NO _x ,...) but is due to concentration changes. The only way about this is to say the ERF due just to the concentration change of GHG is... [Michael PRATHER, United States of America]	Taken into account. Text clarified and simplified
16671	9	13	9	13	Suggest using "halogenated" rather than "synthetic" gases. It's not obvious the non-expert would know what synthetic gases are. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
25787	9	13	9	14	A definition of "synthetic gases" listing the gases included in this concept could be helpful. [Don Alfonso Pino Maeso, Spain]	Taken into account. Text clarified and simplified
27769	9	14	9	14	The corresponding figure is needed for "the remainder". [Eric Brun, France]	Taken into account. Text clarified and simplified
11581	9	14	9	15	Upward revision of CH ₄ SW forcing: should a number (% increase?) be given? [Gerhard Krinner, France]	Taken into account. Text clarified and simplified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44715	9	14	9	15	How large is the "upward revision"? Significant? What does "high confidence" apply to? [Markku Rummukainen , Sweden]	Taken into account. Text clarified and simplified
76993	9	14	9	16	Why is ERF for tropospheric (ground level) ozone not included? [Emer Griffin, Ireland]	Taken into account. Text clarified and simplified
69333	9	14	9	16	It would be useful for readers to add reasons why the estimated shortwave forcing from CH ₄ has been revised upward since AR5. [Kaoru Motosaki, Japan]	Taken into account. Text clarified and simplified
54613	9	14	9	17	This information about an upward revision to the CH ₄ shortwave forcing and details about halocarbon forcing are details of questionable relevance to policy-makers. They distract from the main messages in this paragraph about the main contributors to GHG forcing. [Nancy Hamzawi, Canada]	Taken into account. Text clarified and simplified
81413	9	14			After remainder add the residual (0.75Wm ⁻²) – which is quite substantial. Consider breaking this down and summarising all the radiative forcing contributions in a table. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
41233	9	15	9	15	Not really an "upward revision". It is more an additional process that was not included previously [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
16673	9	15	9	15	It is not an "upward revision" of the shortwave forcing. It is "inclusion" - it was completely missing in previous reports. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
108237	9	15	9	15	"solar-spectrum forcing" would be more generally understandable than "shortwave" [Johannes Quaas, Germany]	Taken into account. Text clarified and simplified
110789	9	15	9	17	I find this last sentence too complicate to understand. [cathy clerbaux, France]	Taken into account. Text clarified and simplified
69835	9	15	9	17	The sentence is inaccurate. HFCs do not deplete ozone and accounted for 0.03 Wm ⁻² in 2016. World Meteorological Organization, United Nations Environment Programme, National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and European Commission (2018). Scientific Assessment of Ozone Depletion: 2018. Geneva. Global Ozone Research and Monitoring Project-Report No. 58. ES.38 ("Radiative forcing from measured HFCs continues to increase; it currently amounts to 1% of the total forcing from all long-lived greenhouse gases. The radiative forcing arising from measured atmospheric mole fractions of HFCs totaled 0.030 W m ⁻² in 2016, up by 36% from 0.022 W m ⁻² in 2012; HFC-134a accounted for 47% of this forcing in 2016, while the next largest contributors were HFC-23 (17%), HFC-125 (15%) and HFC-143a (10%). Total HFC radiative forcing in 2016 accounted for ~10% of the 0.33 W m ⁻² supplied by ODSs (see Chapter 1), and 1.0% of the 3 W m ⁻² supplied by all long-lived GHGs combined, including CO ₂ , CH ₄ , N ₂ O, ODSs and HFCs.") [Gabrielle Dreyfus, United States of America]	Taken into account. Text clarified and simplified
93611	9	15			The "high confidence" cannot relate to the statement that the SW RF of CH ₄ has been revised upward, as it is a fact. If it is related to the ERF estimates (lines 9-14), it should be place there. [Jean-Louis Dufresne, France]	Taken into account. Text clarified and simplified
41235	9	16	9	16	"halocarbons" - unclear whether this specifically means ODSs and a comma is probably needed after "direct", to remove significant ambiguity in meaning [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
104083	9	16	9	17	ozone depleteion=>stratospheric ozone depletion. [Philippe Tulkens, Belgium]	Taken into account. Text clarified and simplified
27771	9	17	9	17	This is not clear: please explain the range of what. [Eric Brun, France]	Taken into account. Text clarified and simplified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9619	9	17	9	17	I don't think this sentence as written now is correct. I prefer the corresponding sentence in the box (line 4). GHG warms more than is observed because there is a compensating effect from aerosols. So it's not 90% of the warming from GHG that ends up in the ocean, but less of it. It's 90% of the energy added to the system, which itself can be attributed to GHG. [Olivier Boucher, France]	Taken into account. Text clarified and simplified
37433	9	19	9	19	Who measured aerosols in 1750? No-one. It's not even clear where your assumptions came from because neither 2.2.8 or 2.2.6 (which actually discusses aerosols but only mentions 1750 in two introductory sentences and one summary sentence) show any evidence of 1750 aerosol levels. [John McLean, Australia]	Taken into account, the SPM2 figure in the final SPM presents the GSAT change due to emission change between 1850-1900 and 2010-2019.
129871	9	19	9	19	The first sentence of B.1.6 should be rewritten to make clear to the reader the direction of change (i.e., increase or decrease). [Trigg Talley, United States of America]	Taken into account, text reworded for clarity
86099	9	19	9	19	This paragraph is very technical and hard to understand. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account, paragraph now deleted
35261	9	19	9	19	You need to change the number at the end of the sentence to -0.5 (zero to -1.0) to reflect the updated forcing of Lewis and Curry 2018 (Journal of Climate) following the reformulation of sulphate forcing by Stevens. I realize you have to use the larger mean because otherwise things get too hot (unless, as Lewis and Curry demonstrate) the sensitivity to carbon dioxide is lower than in the tuned (=fudged) ECMs. [patrick Michaels, United States of America]	Taken into account in overall ERF assessment, paragraph now deleted
129869	9	19	9	21	This statement does not seem supported by text in Section 2.2.8 and, in fact, seems to be contradicted by text and numbers given in Section 2.2.6. [Trigg Talley, United States of America]	Taken into account, text reworded
129873	9	19	9	21	[CONFIDENCE] The uncertainty range in the aerosol ERF is significant (-2.0 to -0.4). In light of this, it seems inappropriate to state that the ERF from aerosol-cloud interactions is 3/4 without any confidence or likelihood statement. This phrase is currently stated as fact; however, the science does not justify the 3/4 to 1/4 ratio of aerosol-cloud and aerosol-radiation contributions to the aerosol ERF. [Trigg Talley, United States of America]	This number is no longer presented in the SPM as too detailed
50149	9	19	9	21	Please could you clarify if this statement ('The total ERF from changes in aerosols from 1750 to 2018 is -1.1 (-2.0 to -0.4) W m ⁻² ') implies that clouds have increased due to observed changes in aerosols and therefore this has reduced radiative forcing? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
131699	9	19	9	25	This paragraph is really difficult to understand due to the usage of technical jargon. [Hans Poertner and WGII TSU, Germany]	Taken into account, paragraph now deleted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68215	9	19	9	25	In changes to ERF from aerosols, add that there are aerosols, specifically black carbon and brown carbon, that add warming (and a significant amount, according to Bond et al 2013) as part of this calculation; also the impact of BC deposition on snow/ice surfaces. The goal should be to ensure that reductions of black and brown carbon occur faster than reductions of the cooling sulfates. Qian Y., et al. (2014) Light-absorbing Particles in Snow and Ice: Measurement and Modeling of Climatic and Hydrological impact, ADVANCES IN ATMOSPHERIC SCIENCES 32:64–91; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA; International Energy Agency (IEA) (2016) WORLD ENERGY OUTLOOK SPECIAL REPORT: ENERGY AND AIR POLLUTION; World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES; Ramanathan V. & Xu Y. (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Nat'l. Acad. Sci. 107(18):8055–8062. [Durwood Zaelke, United States of America]	Taken into account. This is too detailed for the SPM but covered in Chapter 6
68217	9	19	9	25	While not GHGs, black and brown carbon aerosols also are important climate forcers and comes from some similar sources that should be considered part of this discussion. While organic carbon is reflective, the warming effect of black and brown carbon components overall amplify warming. Black carbon is a powerful climate-warming aerosol that directly warms the atmosphere by absorbing solar radiation and indirectly by darkening snow and ice surfaces. Nearly 90% of black carbon emissions come from residential solid fuels, diesel engines, and residential coal; the rest of the emissions come from aviation, shipping, and flaring. Reducing black carbon is especially beneficial for the Arctic because black carbon not only warms the atmosphere but also facilitates additional warming. Once black carbon is deposited on the snow and ice, it reduces the reflectivity (albedo) and absorbs extra solar radiation, which leads to further melting than pristine snow and ice. Since 1890, black carbon has contributed about 0.5–1.4 °C of warming to the Arctic. Bond T. C., et al. (2013) Bounding the role of black carbon in the climate system: A scientific assessment, J. GEOPHYSICAL RESEARCH-ATMOSPHERES 118(11):5380–5552; Myhre G., et al. (2013) CHAPTER 8: ANTHROPOGENIC AND NATURAL RADIATIVE FORCING, in IPCC (2013) CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Table 8.A.6; Qian Y., et al. (2014) Light-absorbing Particles in Snow and Ice: Measurement and Modeling of Climatic and Hydrological impact, ADVANCES IN ATMOSPHERIC SCIENCES 32:64–91; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA; International Energy Agency (IEA) (2016) WORLD ENERGY OUTLOOK SPECIAL REPORT: ENERGY AND AIR POLLUTION; World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES.; Shindell D. & Faluvegi G. (2009) Climate response to regional radiative forcing during the twentieth century, Nature Geoscience 2:294–299; Froyen Y., et al. (2012)	taken into account. This is too detailed for the SPM but covered in Chapter 6

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66717	9	19	9	25	In changes to ERF from aerosols, add that there are aerosols, specifically black carbon and brown carbon, that add warming (and a significant amount, according to Bond et al 2013) as part of this calculation. Also black carbon directly warms the atmosphere by absorbing solar radiation and indirectly by darkening snow and ice surfaces. The goal should be to ensure that reductions of black and brown carbon—in addition to mitigation of other SLCPs that may arise from similar sources—occur faster than reductions of the cooling sulfates. While organic carbon is reflective, the warming effect of black and brown carbon components overall amplify warming. Nearly 90% of black carbon emissions come from residential solid fuels, diesel engines, and residential coal; the rest of the emissions come from aviation, shipping, and flaring. Reducing black carbon is especially beneficial for the Arctic because black carbon not only warms the atmosphere but also facilitates additional warming. Once black carbon is deposited on the snow and ice, it reduces the reflectivity (albedo) and absorbs extra solar radiation, which leads to further melting than pristine snow and ice. Since 1890, black carbon has contributed about 0.5–1.4 °C of warming to the Arctic. Bond T. C., et al. (2013) Bounding the role of black carbon in the climate system: A scientific assessment, J. GEOPHYSICAL RESEARCH–ATMOSPHERES 118(11):5380–5552; Qian Y., et al. (2014) Light-absorbing Particles in Snow and Ice: Measurement and Modeling of Climatic and Hydrological impact, ADVANCES IN ATMOSPHERIC SCIENCES 32:64–91; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA; International Energy Agency (IEA) (2016) WORLD ENERGY OUTLOOK SPECIAL REPORT: ENERGY AND AIR POLLUTION; World Bank & International Cryosphere Climate Initiative (2013) ON THIN ICE: HOW CUTTING POLLUTION CAN SLOW WARMING AND SAVE LIVES. Myhre G., et al. (2013) CHAPTER 8: ANTHROPOGENIC AND NATURAL RADIATIVE FORCING, in IPCC (2013) CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS, Working Group I Contribution to the Fifth Assessment Report of the IPCC	Taken into account. This is shown figure SPM.2 but not detailed in the text, for conciseness. Please see sections 6.4.2 and 7.3 for more details about black carbon.
76995	9	19	9	25	This section is unclear, number should be used not just statements of relative values. [Emer Griffin, Ireland]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
69839	9	19	9	25	Differentiate between warming and cooling aerosols, as different mitigation measures will affect their relative loading, and if cooling aerosols are removed more quickly than warming aerosols, there will be a net warming effect. Ramanathan V. & Xu Y. (2010) The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues, Proc. Nat'l. Acad. Sci. 107(18):8055–8062. Consider also the 0.5 to 1.4°C warming in the Arctic due to black carbon and radiative forcing estimates in Bond T. C., et al. (2013) Bounding the role of black carbon in the climate system: A scientific assessment, J. GEOPHYSICAL RESEARCH–ATMOSPHERES 118(11):5380–5552 [Gabrielle Dreyfus, United States of America]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
69335	9	19	9	25	Chapter 7 Executive Summary on Page 6 from Line 24 to 25 reads, "There has been an increase in the estimated magnitude but a marked reduction in the uncertainty of the total aerosol ERF relative to AR5..." This reduced uncertainty would seem worth included in B.1.6 in the SPM. [Kaoru Magosaki, Japan]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
65533	9	19	9	25	Suggest clarification by including a comment on changes in levels of understanding and confidence since the AR5, considering the estimate has doubled. [Kushla Munro, Australia]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65535	9	19	9	25	Suggest rephrasing this paragraph, e.g. to clarify that the estimate of cloud related forcing has doubled from increase in understanding and measurement/modelling etc., rather than the forcing itself having changed since the AR5. [Kushla Munro, Australia]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
111445	9	20	9	20	Change to "interactions contributes about 75% of the total aerosol ERF" [James Renwick, New Zealand]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
81827	9	20			Use of 3/4 seems a bit odd. Would this not be better as a percentage? "about 75 per cent" [Dan Zwart, New Zealand]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
36093	9	20			drop 'to the magnitude', unnecessary [Michael PRATHER, United States of America]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
69337	9	21	9	23	It would be useful for readers to add reasons why magnitude of ERF has been revised since AR5. [Kaoru Magosaki, Japan]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
93613	9	21	9	24	Same comment as for point B.1.5: The "high confidence" cannot relate to the statement that the ERF magnitude of aerosol has been doubled since AR5, as it is a fact. [Jean-Louis Dufresne, France]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
37435	9	21	9	25	You mention aerosol-cloud interactions earlier in this paragraph and wouldn't you agree that more aerosols leads to more cloud formation? I suggest that a reduction in aerosols when mankind made a conscious effort to reduce air pollution led to a decrease in cloud cover and that decrease led to higher temperatures. [John McLean, Australia]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
36095	9	21			likewise drop 'the forcing associated with' as this is already implied. Also can you put "direct" in front of aerosol-radiation, since aerosol-cloud also involves radiation interaction. [Michael PRATHER, United States of America]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
41237	9	22	9	22	"doubling" - I think it would be helpful to hint at the reasons for this, especially in the light of decreasing optical depth mentioned earlier (at 9:1) [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
129875	9	22	9	23	In B.1.6, as now written, it is unclear if the "recent doubling of the magnitude of ERF from aerosol cloud interactions ..." is a true physical change compared to estimates in 2011, or a change due altering methodologies. [Trigg Talley, United States of America]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
31575	9	22	9	23	It could be made clear here that this is due to advance in understanding rather than a temporal change [Jean-Baptiste SALLEE, France]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
54615	9	24	9	25	Space permitting, the last sentence of this paragraph about the decline in relative importance of aerosol forcing could be expanded to explain why this is the case (e.g. in terms of changes in emissions or atmospheric levels). [Nancy Hamzawi, Canada]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
27773	9	24	9	25	This is true for the magnitude of the aerosol forcing, not the aerosol forcing (which is negative). [Eric Brun, France]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
9613	9	24	9	25	this is true for the magnitude of the aerosol forcing, not the aerosol forcing (which is negative). [Olivier Boucher, France]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
76997	9	24	9	25	The last sentence is important. However, it is not stated why this happened or what it means. [Emer Griffin, Ireland]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM

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36097	9	24			This statement worries me, can you compare just to total? Some other forcings may have declined. [Michael PRATHER, United States of America]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
84701	9	25	9	25	better to have years' interval instead of "most recent 30 years" [Annalisa Cherchi, Italy]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
50151	9	25	9	25	Has the relative importance of aerosol forcing decreased in the most recent 30 years due to increased greenhouse gases over this period, despite increased ERF from aerosols? It would be helpful to briefly clarify the reason for this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
7677	9	25	9	25	It is suggested to delete "most" - it is only confusing because the "recent 30 years" is already clear without this additional qualification. [Klaus Radunsky, Austria]	Taken into account in overall ERF assessment of Chapter 7, paragraph now deleted as too detailed for SPM
37437	9	27	9	27	Please clarify here that you are only talking about the direct effects of changes in TSI. [John McLean, Australia]	See 90171
41293	9	27	9	27	Maybe reformulate: "Changes in ERF due to solar variability amount to -0.01 (-0.05-0.1) Wm ⁻² . These changes and episodic..." [Alexander Nauels, Germany]	See 90171
86101	9	27	9	27	Reorder this bullet. Currently it is volcano – solar – volcano. [Debra Roberts and the Durban WGII TSU, South Africa]	See 90171
111447	9	27	9	27	Change to "due to solar radiation fluctuations" [James Renwick, New Zealand]	See 90171
104085	9	27	9	27	Replace "due to solar" with "due to changes in solar activity". [Philippe Tulkens, Belgium]	See 90171
54617	9	27	9	28	Given that the total anthropogenic forcing is 2.53 W/m ² and the forcing from natural factors is -0.01 W/m ² , the conclusion that natural forcings are "small in comparison to other drivers (high confidence)" seems surprisingly weak. This is a two-orders-of-magnitude difference. Is "small" used because the comparison is to individual (vs total) anthropogenic forcings? Could a stronger statement be made if natural forcings were compared to the total anthropogenic forcing? It would be helpful to include the total anthropogenic forcing in this paragraph to compare to the natural forcings. The total anthropogenic forcing is not currently given in any of the paragraphs in section B.1. [Nancy Hamzawi, Canada]	See 90171
10863	9	27	9	28	Figure 2.10 shows large variations in volcanic forcing over last 100s years. Just comparing 1750 to 2018 is misleading. [Gareth S Jones, United Kingdom (of Great Britain and Northern Ireland)]	See 90171
90171	9	27	9	31	It is very difficult to get the main message for policy-makers out of section B.1.7. Please rewrite to make the message that natural variability had no discernable impact on the observed warming since 1750 get out more clearly. [Georges Gehl, Luxembourg]	Not applicable. This text. has been removed from the FGD draft for space reasons. Natural forcing contributions to attributable warming are given in HS1.2 instead
105579	9	27	9	31	Could cross-reference here statement A.2.3. about the hiatus [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	See 90171

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4549	9	27	9	31	This misleading statement hides the fact that the second half of the 20th century was one of the most active phases of the entire Holocene. See Steinhilber et al. 2012 (doi 10.1073/pnas.1118965109) and Solanki et al. 2004, https://www.nature.com/articles/nature02995 . In contrast to sun spots, the solar magnetic field reached its highest values in the late 20th Century. The solar climate effect is associated with time lags and energy is likely accumulated over several cycles. The brief solar high of the 1960s was much too short to have been fully implemented by the sluggish climate system. Non-linear links of solar activity with ocean cycles such as PDO, AMO, NAO are being described in the literature. Therefore: Either delete the claim or add the longerterm centennial trend as based on solar magnetic field and cosmic rays. Palaeoclimate case studies have produced numerous examples of a strong solar imprint on the climate development, yet models still struggle to replicate the climate of the past. Why are you not discussing this enigma here? Do we trust theoretical models more than the climatic reconstructions? Are thousands of papers wrong that documented a clear solar imprint on climate that cannot be reconciled with the extremely small forcing that IPCC assumes for solar activity changes? It is about time to actively address this "elephant in the room". I am disappointed that this chapter ignores this issue. Another missed opportunity. Why are you not discussing potential UV amplification effects on climate though stratosphere-troposphere interaction? Why do you not mention that solar effects on climate are likely non-linear and modulated through "modes of variability" namely multidecadal and shorter cycles such as AMO, PDO, NAO, SAM, ENSO? [Sebastian Luening, Switzerland]	See 90171
32357	9	27			The way values for solar ERF are indicated are not consistent with the other indications, which makes it a bit confusing. [Clemens Schwingshackl, Norway]	See 90171
101551	9	27			Change "due to solar" to "due to solar activity" [Knut Nadelhoffer, United States of America]	See 90171
79345	9	27			...due to solar (-0.01 (-0.05-0.1) Wm-2) and episodic... Comment: The external paranthesis are not used in values cited further up. [Rolf Philipona, Switzerland]	See 90171
37439	9	28	9	31	I'm sure that neither TSI or episodic volcanic eruptions were not unusual compared to the AVERAGE of the past 9000 years (solar) and 2500 years (volcanoes) but that's not the point; it's how they compare to episodes over those periods. [John McLean, Australia]	See 90171
108545	9	29	9	31	Unclear, could these lines be re-worked. I had trouble understanding what was being said. [Jason Donev, Canada]	See 90171
110791	9	30	9	30	"has not been unusual" weird formulation [cathy clerbaux, France]	See 90171
104087	9	31	9	31	Suggest to add: "Taken together it is extremely unlikely that variability in drivers of natural origin have a substantial role in climate change observed since 1900. [Philippe Tulkens, Belgium]	See 90171
8103	9	31	9	31	Suggest to add: "Taken together it is extremely unlikely that variability in drivers of natural origin have a substantial role in climate change observed since 1900. [Frank Dentener, Italy]	See 90171
112193	9	32	9	32	I am missing seeing something about the observed energy imbalance, say, as observed by the CERES satellite. There is about a 20-year record now, and this is the best information we have currently on how the Earth's shortwave and longwave components of the energy balance have behaved over the past two decades. [venkatachalam ramaswamy, United States of America]	See 90171

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27775	9	34	9	34	This term is unclear and needs to be explained. The composition of the atmosphere is addressed in section B.1, and precipitations are also addressed in B.2. [Eric Brun, France]	Taken into account. This statement has been completely reformulated in the FGD and in doing so this has been addressed.
66521	9	34	9	34	Changes in mean wind surface wind (from Ch12) could be added in Section B.2, relating also CIDs with sectoral links to energy and agriculture. CH12 can provide statements about this. This could be a short B.2.6 [robert vautard, France]	Rejected. Space constraints preclude such an addition
105583	9	34	9	42	The A.2 headline statement says something about GSAT which is very robust and then talks about atmospheric circulation+water cycle which are less robust. There seems to be a gap in statements about other robust temperature changes e.g. troposphere/stratosphere, polar amplification, land-sea contrast. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This statement has been completely reformulated in the FGD and in doing so this has been addressed.
129877	9	34	10	27	B2.2 cites the impact of stratospheric ozone thinning on stratosphere temperatures (cooling) and B.2.3 attributes a shift in weather patterns (contributing to poleward shift of jet streams) to a combined effect of human-caused stratospheric ozone thinning and increases in tropospheric greenhouse gases; however, there is no mention of ozone in the B.2 chapeau. Given the high likelihood and confidence level of inferences regarding the impact of human-induced stratosphere ozone losses on climate systems, it should be specifically mentioned by modifying the second sentence as follows (added language in CAPITALS): "Several aspects of the atmospheric circulation have likely changed since the mid-20th century, including widening of the tropical belt and poleward jet migration, and there is medium confidence that human influences, INCLUDING STRATOSPHERIC OZONE DEPLETION AS WELL AS GREENHOUSE GAS EMISSIONS, contributed to these changes." [Trigg Talley, United States of America]	Rejected. Headline statements have been much shortened, preventing the addition of such details.
69339	9	34	11	47	The readability of the SPM is often enhanced by carefully prepared figures with great attention to detail. As such, regarding the Section B2, each of the Figures SPM.3, SPM.4 and SPM.5 would merit very thorough explanation. [Kaoru Magsaki, Japan]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
105581	9	34	15	13	What is missing here is anything about mean changes in temperature over land. Nothing quantitative about polar amplification or land-sea contrast. I wonder if section A.2 should really be 'Atmosphere and Land' and should include these aspects? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Warming over land provided in HS1.2. Note that the headline statements (e.g. A.2.) no longer have headings.
87325	9	36	9	36	add; by 1.1 degrees Celcius [Marcel Berk, Netherlands]	Not applicable. This part of the SPM has been completely rewritten. Note however that warming value is now provided in HS1.2.
27777	9	36	9	36	We propose to delete the first part of the sentence, because this is already expressed in the corrigendum. [Eric Brun, France]	Statement completely rewritten
9483	9	36	9	37	Again, these summary statements need to be as clear as possible for a policy maker audience. Suggest: Global surface air temperature has increased rapidly since 1850. Over the past fifty years, global temperature has increased at a rate unprecedented in at least the last two thousand years (medium confidence). [Joelle Joelle Gergis, Australia]	Taken into account. The phrasing of HS2.2 is now much clearer/straightforward.

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93739	9	36	9	37	Right now it looks like there is medium confidence that "global surface air temperature has increased since 1850", but is it really the case or does this statement only apply to the second part of that sentence? [Quentin Lejeune, Germany]	Taken into account. The medium confidence is on the 2000 years. We hope that the revised bullet (HS2.2) is now clearer.
37441	9	36	9	37	Ice cores from Greenland suggest that the last 800 years was the longest cold period of the last 10,000 years and that over that 10,000 years there have been periods when temperatures changed sharply. Can you explain why temperatures should NOT have risen sharply after 800 years of being very low? [John McLean, Australia]	Rejected. Comment made without justified literature references and is at odds with underlying assessment
54625	9	36	9	37	The medium confidence qualifier here seems to (or could be taken to) contradict assessments on pg. 4, lines 22-24, which states that human influence on the climate system is an established fact, and on pg. 4, line 34, which states that 'observations provide unequivocal evidence of a changing climate'. [Nancy Hamzawi, Canada]	Taken into account. The statement has been teased apart to avoid this ambiguity across what are now the first two HSs of the SPM (HS.1 and HS.2)
97227	9	36	9	37	The sentence states "at a rate unprecedented in at least the last two thousand years (medium confidence)". Why only during the last 2000 years, and why only with medium confidence? Is this due to a lack of knowledge, lack of evidence, lack of agreement? [Nicole Wilke, Germany]	Taken into account. Via Figure SPM.1 and the revised HS2 this has been clarified
27791	9	36	9	41	We suggest that the authors add in the headbox B.2 a main message summarizing the most important information about the recent changes in precipitation at global and regional scale. It is a very important topic expected by the policymakers. [Eric Brun, France]	Taken into account,. The restructured SPM has an entire section given over to changes in the hydrological cycle and changes in precipitation are covered under HS1.4
90173	9	36	9	42	The sentence "Global surface air temperature has increased since 1850, and, over the past fifty years, it has done so at a rate unprecedented in at least the last two thousand years (medium confidence)." together with the last sentence "There is high confidence that since pre-industrial times human activities have strengthened the global water cycle" seem to be a main message of the WG1 contribution to AR6 and should be maintained. We propose to additionally add the sentence to the main message from the underlying bullets (B2.1): "From 1850-1900 to 2009-2018, GSAT increased by 1.10°C (0.97° – 1.25°C)." (please note of general comment on the issue of temperature re-assessment in the AR6) [Georges Gehl, Luxembourg]	Taken into account. Between the headlines in HS.1 and HS.2 these points are broadly covered although not in the combined manner suggested/
54621	9	36	9	42	Recommend adding to this headline statement a statement based on Figure SPM.3 that says something like "the best estimate of net human influence on GSAT is approx equal to the observed warming". This would complement the details about warming due to different factors in para B.2.1. There is no statement currently in the SPM about how much of the observed global warming is attributable to human influence. [Nancy Hamzawi, Canada]	Taken into account. The headline statements have been simplified. However, in redrafting this attributable warming aspect is more clearly pulled through.
87173	9	36	9	42	After the corrigendum provided 7 April there seems to be a overlap with information already provided in headline conclusion B.1 regarding how human activities has altered the climate system. Please consider if this information is needed both places. If kept here, please consider to find a better word than "unequivocal". It might be due to not having english as our mothertongue, but there must be better alternatives that are easier to understand. Word like "clear" or "undisputable" are alternatives that you could consider to help readers undertstand you message easier. [Oyvind Christophersen, Norway]	See 27777

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130443	9	36	9	42	The key message on "Temperatures have increased faster over land than over the ocean since 1850-1900, with warming to 2009-2018 of 1.44 °C (1.32 – 1.60 °C) versus 0.89C " is new from recent approved IPCC SRCCL. It does not need to depuplicate this statement here. Also, please note that 0.89C is for GMST, not for ocean. [Panmao Zhai, China]	Rejected. This statement is highly policy relevant and bears repeating. The 0.89 is for the ocean
9615	9	36	9	42	This paragraph is not quantitative enough in my opinion. [Olivier Boucher, France]	Taken into account. Relevant statements have quantification added in the FGD
86935	9	36	9	42	Please consider to eplixit give the number of the temperature (GSAT or GMST) increase since 1850-1900 to 2009-2018. This could be done by including "with approximately X.X °C" before "since 1850, and, over the past fifty ...". This information is a highly policy-relevant with respect to the temperature goal under the Paris Agreement. With such an addition to this sentence, the second new sentence, that was provided in the corrigendum 7 April, can be made easier. We also suggest that the minor differences between the periods that are assess and observed is not explicitly included in the headline conclusion itself, but left for one of the associated bullets to this section (B.2). Please consider if the second new sentence could simply read "The likelyrange of human-induced warming of 0.8-1.4°C is consistent with the best estimate of observed warming." [Oyvind Christophersen, Norway]	Taken into account. This number is now clearly and prominently given under HS1.2
5283	9	36	9	42	A generally well-written red box with short, direct statements. In keeping with putting the most important conclusions in the red boxes, isn't a high confidence statement about the monsoons (B2.5, monsoons are directly important to hundreds of millions of people) more important than a "likely" statement about the widening of the tropical belt (rather abstract to policy makers). [Daniel Murphy, United States of America]	Taken into account. Text completely rewritten and monsoon changes better emphasised in the redrafted SPM
78265	9	36	9	42	It would be useful to include some headline figures on the increase in GMST since 1850. [Leonie Lee, Singapore]	See 86935
101561	9	36	9	42	The wording as presented in the Corrigendum for the IPCC AR6 Working Group I SOD is an important improvement. [Knute Nadelhoffer, United States of America]	See 27777
76999	9	36	9	42	This is a very technical statement and the message for policy makers is not clear. [Emer Griffin, Ireland]	Taken into account. This text has been removed and replaced with simpler more intuitive statements
87247	9	36	9	42	Please add a sentence stating the estimated human influence in the temperature increase since the reference period 1850-1900 in a similar way it was done in SR1.5 (1 C (0.8-1.2)). This is very helpful in the communication. [Marcel Berk, Netherlands]	Taken into account. This information is now given in HS1.2
42207	9	36	9	42	B2 headline: "global water cycle" is too technical. Could the sentence be rewritten with direct reference to evaporation and precipitation? [Tina Christensen, Denmark]	Taken into account. These aspects have been simplified in the redrafted HS1.4
50143	9	36	9	42	The key question that a policymaker will have in section B2 will be how much warming has taken place. Based on this I would recommend that the rise in GSAT from 1850-1900 to today, as stated in B2.1, is elevated to the headline B2 statement. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. In the revised HS1.2 this is given due prominence

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41097	9	36	9	43	This statement starts off with a medium confidence statement goes to likely and then to medium again, which makes it seem that there is some uncertainty in what is occurring in the atmosphere. Maybe the statement "It is very likely that human influence, dominated by greenhouse gases, was the main driver of warming of the troposphere since the start of comprehensive satellite observations" could also be included in the headline statement? [TSU WGI, France]	Taken into account. Statement has been completely rewritten for clarity and no longer exists as a standalone statement
36099	9	36			You missed the attribution to the GSAT change (certain?) but put it in the lesser two changes noted here. It should probably be stated in this headline. ***** OK, this is fixed in errata [Michael PRATHER, United States of America]	Noted
81415	9	36			Add "by 1.10 oC" after 1850 [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This part of the SPM has been completely rewritten. Note however that warming value is now provided in HS1.2.
129879	9	36			Edit first sentence of B.2 to read "Global surface air temperature has increased since 1850 (high confidence)" to avoid confusion with the subsequent statement of only medium confidence at the sentence's ending on line 37 to pertain to this GMST rise. [Trigg Talley, United States of America]	Rejected. The 1850 onwards warming is a statement of fact and not a confidence based finding in the underlying assessment. The two points have, anyway, been clearly separated in the final draft.
131983	9	36			It seems important to include the temperature change here in GMST and GSAT as the question clearly is how does this relate to carbon budget and Paris temperatures. [Hans Poertner and WGII TSU, Germany]	Taken into account. Substantial revisions to cross-chapter box 2.3 following SOD reviews led to a comprehensive reassessment and rewriting of findings in this regard
101553	9	36			Change "since 1850," to "since 1850" [Knut Nadelhoffer, United States of America]	Editorial copy edit
37443	9	37	9	37	If you have only "medium confidence" in something then why do you state it as if it is a fact or even discuss it at all given that you are so uncertain? [John McLean, Australia]	Rejected. The confidence pertained only to a subset of the statement, but the statement anyway has been completely reworked and the potential for confusion no longer pertains
12103	9	37	9	37	...upper 1 km... [Prabir Patra, Japan]	Misplaced comment or insufficient context to be actionable
54619	9	37	9	37	One of the most used and impactful statements from the IPCC SR1.5 was that human activities are estimated to have caused approx. 1.0°C of global warming above pre-industrial levels (with uncertainty levels). The absence of a similar statement in the AR6 SPM is notable. We would recommend including an updated statement about the level of human-induced warming to date, either here in headline B2 or in A1 headline or supporting para A1.6. [Nancy Hamzawi, Canada]	Taken into account. Such a statement is now included as part of the redrafted HS1.2
27779	9	37	9	37	Please double check the confidence level for the second part of the sentence. [Eric Brun, France]	Taken into account. This finding has now been split across HS1 and HS2 to avoid the confusion
27781	9	37	9	37	Concerning the missing paragraph added in the corrigendum : "The likely range of human-induced warming of 0.8-1.4°C is consistent with the best estimate of observed warming of 1.1°C (the assessed anthropogenic warming and observed warming are for 2010-2019 and 2009-2018, respectively, in global surface air temperature (GSAT) relative to 1850-1900)." 1) What are the assessed anthropogenic warming and observed warming are for 2010-2019 and 2009-2018 and where are they indicated? 2) What is the difference between an GSAT increase of 1.1°C and the GMST increase indicated on p5 line 40 (figure SPM1 legend)? [Eric Brun, France]	Taken into account. The difference in periods arises due to unavoidable delays between the observational estimates being available and updated attribution analyses being completed. Sadly owing to the phasing despite both periods being updated a continued mismatch by one year had to persist into the final government draft.
81499	9	37	9	40	Recommend to further elaborate "...including widening of the tropical belt and poleward jet migration...". [Ee Ling Lee, Malaysia]	Taken into account. Changes in circulation now more clearly discussed in the revised HS1 content

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54445	9	37	9	40	In order to express the following statement in a clearer manner and in line with the previous sentence, we suggest the following form: Several aspects of the atmospheric circulation have likely changed since the mid-20th century, including widening of the tropical belt and poleward jet migration, and human influence contributed to these changes (medium confidence). Otherwise it seems that what has been highlighted is the level of confidence... [Maria del Pilar Bueno Rubial, Argentina]	Taken into account. This has been completely redrafted and the source of confusion should no longer pertain
90893	9	38	9	40	In order to express the following statement in a clearer manner and in line with the previous sentence, we suggest the following form: Several aspects of the atmospheric circulation have likely changed since the mid-20th century, including widening of the tropical belt and poleward jet migration, and human influence contributed to these changes (medium confidence). Otherwise it seems that what has been highlighted is the level of confidence... [Alvaro Zopatti, Argentina]	See 54445
87327	9	39	9	39	change poleward jet migration into: poleward shift of the jet stream [Marcel Berk, Netherlands]	Taken into account. Statement has been redrafted for clarity
86103	9	39	9	39	Suggest rewording "poleward jet migration" to "the jet streams have shifted poleward" [Debra Roberts and the Durban WGII TSU, South Africa]	See 87327
25789	9	39	9	39	A definition of "jet migration" could also be useful. [Don Alfonso Pino Maeso, Spain]	See 87327
3583	9	39	9	39	Readers may wonder why "it is now an established fact in AR6 that human activity has altered the climate system since the mid-20th century" (see lines 22-24 of page 5 of SPM), if confidence level is "medium" (not "high") that human influence contributed to these changes. [Mitsutsune Yamaguchi, Japan]	Taken into account. The statement is now split across HS1 and HS2 to avoid such confusion
37445	9	40	9	40	Do you know the strength (whatever that means) of the global water cycle in 1750, at which time Europe was suffering in the Little Ice Age? If you do then say how, else remove the sentence. [John McLean, Australia]	Rejected. The rationale behind the request is specious. For every aspect of the climate system there is some period beyond which we cannot reach further back. Statements have been checked to avoid any potential for misinterpretation in redrafting
27783	9	40	9	40	The high confidence after several medium confidences should be better highlighted. At first look it sounds also strange to have this high confidence when all the circulation indicators have only medium confidence. [Eric Brun, France]	Taken into account. SPM completely reorganised and headline statements redrafted in such a way that this no longer the case
86937	9	40	9	40	Please consider to include "directly" in front of "to these changes". [Oyvind Christophersen, Norway]	Rejected. The formulation is consistent with use throughout the report
9485	9	40	9	41	Clunky phrasing for an important statement, change to read: There is high confidence that human activities have affected the global water cycle since pre-industrial times. [Joelle Joelle Gergis, Australia]	Taken into account in redrafting the statement HS1.4
81501	9	40	9	41	Recommend to replace 'strengthen' to another word that could reflect the 'level of global water cycle being strengthen' clearer. [Ee Ling Lee, Malaysia]	Taken into account in redrafting the statement HS1.4. The ambiguity pointed out by several parties and the connotations have been addressed in so doing.
54623	9	40	9	41	Please ensure wording is consistent between Ch. 8 ES and this statement in the SPM in referring to whether human activities have affected (CH. 8 ES) or strengthened (SPM) the global water cycle since pre-industrial times (high confidence). [Nancy Hamzawi, Canada]	Accepted. Consistency checks made and should now be better across the SPM, TS and chapters 2,3 and 8
20341	9	40	9	41	Is "strengthening the global water cycle" clear for every potential reader? Does that mean an increase in global precipitation for example? Providing a quantitative metric would be an asset [philippe waldteufel, France]	See 81501

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25791	9	40	9	41	This sentence deals with the strengthening of the water cycle since preindustrial times. However, the subsequent paragraphs dealing with the water cycle (B.2.4 and B.2.5) do not refer to preindustrial times but rather 1970s, 1950 or the second half of the 20th century. [Don Alfonso Pino Maeso, Spain]	Taken into account in redrafting of HS1.4
65531	9	40	9	41	For clarification, suggest changing the text to "There is high confidence that since pre-industrial times the increased energy in the climate system from human activities has intensified the global water cycle." [Kushla Munro, Australia]	Rejected. The attribution is directly to anthropogenic forcings and is not to the energy accumulation
9725	9	40	9	41	"strengthened" in last line sounds positive - maybe "intensified"? [Jonathan Lynn, Switzerland]	See 81501
20925	9	40	9	42	Not Clear what it means by "Strengthened Global Water Cycle" [Ladislaus Chang'a, United Republic of Tanzania]	See 81501
44903	9	41	9	41	"Strengthened" could be clarified, the meaning may not be readily clear for all readers. [Markku Rummukainen, Sweden]	See 81501
27785	9	41	9	41	Is the word "strengthened" the best one ? Would "intensified" not be better as in B3? [Eric Brun, France]	See 81501
27787	9	41	9	41	This information should be added after "water cycle" because it is important for policymakers: ": contrast between wet and dry weather regimes increase in a warming climate (high confidence) and increases in water vapour drive intensification of heavy precipitation events and the severity of associated flooding." It can be found in TS, page 81, lines 53 to 56. [Eric Brun, France]	Rejected. This is discussed elsewhere in the SPM and repetition would be unhelpful. It is covered in the totality of the FGD SPM text.
112781	9	41	9	41	consider "insensified" rather than "strengthened" [Maarten van Aalst, Netherlands]	See 81501
42401	9	41	9	41	Is strengthened the right word. Consider intensified? [Tina Christensen, Denmark]	See 81501
29395	9	41	9	41	Further specification needed on the term 'strengthened the water cycle'. Which processes are involved here? [Joachim Fallmann, Germany]	See 81501
17453	9	41			... have strengthened the global water cycle.' This is ambiguous. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	See 81501
110985	9	41			... have strengthened the global water cycle.' What does that mean? What are the implications of a strengthened global water cycle? [Monica Dean, United States of America]	See 81501
53463	9	41			may be more policy relevant and understandable to say: "have strengthened the spatial and temporal variability of the global water cycle"? [Hervé Douville, France]	See 81501
42357	9	42			Global water cycle might not be well known concept for policy makers. [Tina Christensen, Denmark]	See 81501
27789	9	43	9	43	Regarding footnote 7: The formulation is incorrect, please replace with "A measure of the amount of sunlight blocked by aerosols, related to the amount of aerosols in the vertical column of atmosphere.". [Eric Brun, France]	Taken into account. Text no longer present
9617	9		9		footnote 7: not very rigorous definition. I suggest to change "blocked by" by "interacting with". [Olivier Boucher, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
23363	10	1	10	2	The use of "about as likely as not" in combination with the comparison between mean temperature of a multi-centennial period and the mean temperature of a decade seems perfect for confusions. "about as likely as not" means that there is no knowledge other than the "we don't know". Better to exclude this statement or to re formulate. [Anna Amelia Sörensson, Argentina]	Taken into account, attempted to reformulate this passage for clarity. The revised HS2.2 tries to be clearer as to the nature of the comparison being undertaken. The use of more likely than not is consistent with the guide to uncertainty and likelihood and has precedence in prior reports.

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24409	10	1	10	10	GAST is used here while GMST is used in AR5. The difference between the GAST and GMST values should be shown clearly here for further comparison. [Zhou Botao, China]	Taken into account Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM."
77001	10	1	10	10	This may be useful in the Technical summary but is not useful here. [Emer Griffin, Ireland]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context).
77003	10	1	10	10	A simple set of statements on the global temperature trend is needed. [Emer Griffin, Ireland]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context).
65067	10	2	10	2	It is not obvious that a statement with the likelihood label "about as likely as not" should be in the SPM, at least not as the first statement in a section, as it is not very informative [Magnus Joelsson, Sweden]	See 23363
41295	10	2	10	2	To start this important paragraph with this "weak" likelihood statement is not advisable as it may unintentionally send the wrong message to the reader. Suggest to remove sentence here and include further down the paragraph, after reformulation. [Alexander Nauels, Germany]	Accepted. HS2.2 now finishes with the weak likelihood
86105	10	2	10	2	A 50-50 likelihood finding seems unsuitable for the SPM. The second sentence would sound better if worded in terms of change, not warming: "It is likely that anthropogenic factors caused the global surface air temperature to change between 1750 and 1850-1900 by -0.1 to 0.2°C." By the way, what exactly does "1750 and 1850-1900" mean? Is that the 100 years prior to 1850? Could you say it that way? [Debra Roberts and the Durban WGII TSU, South Africa]	See 23363 and 41295
54627	10	2	10	2	Please indicate how long ago the end of the last interglacial period was, which would make the sentence more impactful. Space permitting, it would be worth adding here the assessment from Ch. 2 that the last interglacial was 1.5C ± 0.5C warmer than preindustrial. This would convey to Policymakers that we can usefully look to the last interglacial to understand what a climate that is 1-2C warmer than preindustrial looked like. [Nancy Hamzawi, Canada]	Accepted. 125 thousand years ago now mentioned in HS2.2.
71325	10	2	10	2	Add in brackets the number of years since the end of the last interglacial period - since many policymakers will not know this. [David Wratt, New Zealand]	Accepted. 125 thousand years ago now mentioned in HS2.2.
16053	10	2	10	2	Need to say when the "last interglacial period" was, because policymakers will not know. [Daniel Lunt, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. 125 thousand years ago now mentioned in HS2.2.
117211	10	2	10	2	Include a footnote to explain when the last interglacial occurred [Maisa Rojas, Chile]	Accepted. 125 thousand years ago now mentioned in HS2.2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65539	10	2	10	3	Suggest including a number timeframe on “since the end of the last interglacial period”. [Kushla Munro, Australia]	Accepted. 125 thousand years ago now mentioned in HS2.2.
65541	10	2	10	3	Suggest clarification of this statement. It is unclear why the text compares multi-centennial with decadal length periods. [Kushla Munro, Australia]	See 23363
9487	10	2	10	3	This is another important finding that is buried in difficult language for a non-specialist audience. How about: It is about as likely as not that global temperature over the most recent decade of 2009-2018 was warmer than any other period since the end of the last interglacial. Consider trying to simplify all of B2.1 as it is dense for the reader. Perhaps using the phrase pre-industrial so it's clear what is being assessed here for a non specialist. [Joelle Joelle Gergis, Australia]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context).
90895	10	2	10	3	It is about as likely as not that no multi-centennial period since the end of the last interglacial period was warmer globally than the most recent decade. This sentence seems unconnected to what comes after. [Alvaro Zopatti, Argentina]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context).
29199	10	2	10	3	This sentence is difficult to understand. The double negative "not that no multi-centennial period" might be avoided. [Hiroshi Kanzawa, Japan]	Accepted. HS2.2 now avoids double negative.
111635	10	2	10	3	This sentence is not comparing like with like (a decade with a multi-century period). Since the likelihood is also very weak I don't see what to make of it. Suggest dropping it. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	See 23363
81955	10	2	10	3	it would be helpful to put a number on “since the end of the last interglacial period” [Dan Zwartz, New Zealand]	Accepted. 125 thousand years ago now mentioned in HS2.2.
78655	10	2	10	3	What I understand here is: Maybe or maybe not there were no longer (> 100 years) periods when it was warmer than in the past decade. - This sounds like: We don't know, and likely there is no problem. - The next sentences specify this, so I suggest deleting this sentence. [Heike Wex, Germany]	See 23363
129883	10	2	10	3	This sentence is extremely hard to parse with the prevalence of negatives. [Trigg Talley, United States of America]	Accepted. HS2.2 now avoids double negative.
129887	10	2	10	3	Use of "multi-centennial period" is confusing. Is that referring to a period of several or more centuries, which have not been warmer than the most recent decade? If so, a poor apples to oranges comparison. Really, what should be meant is that no decade (or period) in the multi-centennial record has been warmer than the most recent decade. [Trigg Talley, United States of America]	See 23363
129889	10	2	10	3	It would be helpful to policymakers to state how many years before the present (i.e., end of last interglacial period) this refers to. [Trigg Talley, United States of America]	Accepted. 125 thousand years ago now mentioned in HS2.2.
26467	10	2	10	3	As stated in the beginning of the section, the way the confidence levels and likelihood are expressed in this section follows the protocol, which is used in the entire AR6. However, it is not certain that people, only reading the section of the summary for policy makers, will understand that if something is said to have a "low confidence" it does not automatically mean that there is a high confidence and lot of evidence for the opposite. This sentence here for example, using the "about as likely as not", will with high likelihood be understood as “there is as much evidence against the statements and there is support” and therefore will not mean anything (having a summarized effect = 0). Maybe the expressions of confidence levels in the section of the summary for policy makers, should be more intuitive and easier to understand than in the rest of the report, as these are aimed towards different groups of readers? [Mare Sundström, Sweden]	See 23363

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78961	10	2	10	3	This statement appears very weak, and thus of little relevance for an SPM, due to its lack of certainty ('as likely as not'). If we do not know anything with more than about 50% chances on that topic, we suggest deleting. Otherwise, please reformulate in a way that better shows what this could mean to policymakers. [Martine Vanderstraeten, Belgium]	See 23363
96905	10	2	10	3	"It is about a likely as not.." seems like an incredibly weak way to start a summary bullet. Is there an inverse statement, with stronger certainty assigned that could replace this? [Paul Durack, United States of America]	See 23363 and 41295
27795	10	2	10	3	This is not obvious from Fig SPM.4, and forcing for last interglacial is very different from that for the current change. [Eric Brun, France]	Taken into account. Changes to Figure SPM.1 and text should help clarify intended meaning here
104089	10	2	10	3	The relevance of comparing the mean of a single decade to that of multi-centennial periods could be explained. Can we say that no decade during that period was warmer? [Philippe Tulkens, Belgium]	See 23363
54447	10	2	10	3	'It is about as likely as not that no multi-centennial period since the end of the last interglacial period was warmer globally than the most recent decade'. This sentence seems unconnected to what comes after. [Maria del Pilar Bueno Rubial, Argentina]	See 23363 and 41295
10183	10	2	10	3	This comparison of averages with different bases of support is statistically problematic and will draw fire [Robert Kopp, United States of America]	See 23363
97229	10	2	10	3	It seems a bit weird to compare multi-centennials to a decade. One might read that it is not known of multicentennials (left alone decades), if they were warmer than the last decade. Please revise the wording. [Nicole Wilke, Germany]	See 23363
42209	10	2	10	3	B2.1: Opening sentence - the message is not very clear (that current warming is with some likelihood unprecedented). E.g. why is the recent decade compared to multi-centennial means in the past? We suggest rephrasing or potentially leaving it out - the message is illustrated on figure SPM4. [Tina Christensen, Denmark]	See 23363 and 41295
38899	10	2	10	3	Suggestion to swap the two elements of this sentence: "It is about as likely as not that the most recent decade was warmer globally than any other multi-centennial period since the end of the last interglacial period." [Maike Nicolai, Germany]	Accepted. HS2.2 now avoids double negative.
81647	10	2	10	4	This phrase is complex and hard to derive a meaningful message from it given the likelihood statement- suggest rephrasing [Michael Grose, Australia]	Accepted. HS2.2 now avoids double negative.
86563	10	2	10	5	Issues with GSAT vs GMST (see my number 1 comment). How do you estimate GSAT for 1750 to 1850-1900 as it is not observed? Is this in fact GMST numbers that you report as GSAT numbers here (ie you are assuming GMST = GSAT for 1850-1900) ? Or are you multiplying GMST by a factor ? If yes what is this factor for 1850-1900 and where is it coming from ? This is completely opaque, I'm sorry. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108241	10	2	10	5	I suggest to change the order of the first three sentences. The warming since pre-industrial is the most important statement. So: "From 1850-1900 to... - 1.25°C). It is about as likely... decade. The net ..." [Johannes Quaas, Germany]	Taken into account. Bullet significantly reorganised, streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
78607	10	2	10	10	Paragraph B.2.1 is confusing. It's much clearer to say what has happened rather than what hasn't happened – especially when attaching confidence statements. E.g. "as likely as not that no period was warmer..." – would sound better as "as likely as not that the most recent decade was warmer than any period since..." [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. HS2.2 now avoids double negative.
78609	10	2	10	10	Paragraph B.2.1 is confusing. Consider swapping the sentences about warming to present and warming before pre-industrial. The main point being made is the former – so say this first – present day is 1.1°C warmer. Then mention the caveat that from 1750 there's a small adjustment [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
78611	10	2	10	10	Paragraph B.2.1 is confusing. The second half could be split – keep the first half short and clear about the observed warming. Then have a second paragraph on the attribution to different forcings. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
19219	10	2	10	10	The first sentence does not seem like a good introduction to this SPM statement; could the order of ideas be changed, to start with the present time and then give the paleo perspective? A reference to chapter 4 can be added for the land-ocean contrast. [Anne-Marie Treguier, France]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
44065	10	2	10	10	The SR1.5 stated that "observed global mean surface temperature (GMST) for the decade 2006–2015 was 0.87°C (likely between 0.75°C and 0.99°C) higher than the average over the 1850–1900 period (very high confidence)." Therefore it is very surprising that the AR6 reports an increase in global mean temperature by as much as 1.10°C while the reference period has only been shifted by 3 years. From the underlying chapters, it appears that this is due to methodological changes and notably the new consideration of GSAT instead of GMST. While the need to improve our understanding of evolving global mean temperature is fully justified and the undertaken methodological steps seem to be scientifically founded, it is problematic because of the high policy relevance of the temperature metric used in AR5. As stated above in our comment on the preindustrial reference period, global mean temperature as used in the AR5 was the basis for the Long-Term Temperature Goal of the Paris Agreement. If methodological changes are the reasons behind an increase by more than a tenth of a degree of the global mean temperature increase to date, a more careful explanation of the reasons underlying this discrepancy is highly required all along the report, including in the SPM. In order to track progress towards the LTTG, consistency in the temperature metrics across the ARs is key. To address this consistency issue without discarding the methodological progress, we suggest the authors to consider the provision of temperature changes according to GSAT and the metric used in AR5. [Lamin Mai Touray, Gambia]	Taken into account in the approved version (not FGD). In the approved version, bullet A1.2 states that "The estimated increase in global surface temperature since AR5 is principally due to further warming since 2003–2012 (+0.19 [0.16 to 0.22] °C). Additionally, methodological advances and new datasets contributed approximately 0.1°C to the updated estimate of warming in AR6(10). (10) Since AR5, methodological advances and new datasets have provided a more complete spatial representation of changes in surface temperature, including in the Arctic. These and other improvements have also increased the estimate of global surface temperature change by approximately 0.1°C, but this increase does not represent additional physical warming since AR5. "

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90175	10	2	10	10	Please consider our general comment on temperature re-assessment in the AR6 in this section and provide all explanations to policy-makers why the observed temperature increased by 0,2°C compared to AR5 and to SR1.5 (different reference periods, different temperature metrics: GSAT vs GMST and temperature re-assessment). Also, please include these figures in a footnote to the SPM, so that it is transparent how to compare findings of AR6 to both AR5, SR1.5 and other SRs in the sixth assessment cycle. [Georges Gehl, Luxembourg]	Taken into account in the approved version (not FGD). In the approved version, bullet A1.2 states that " The estimated increase in global surface temperature since AR5 is principally due to further warming since 2003–2012 (+0.19 [0.16 to 0.22] °C). Additionally, methodological advances and new datasets contributed approximately 0.1°C to the updated estimate of warming in AR6(10). (10) Since AR5, methodological advances and new datasets have provided a more complete spatial representation of changes in surface temperature, including in the Arctic. These and other improvements have also increased the estimate of global surface temperature change by approximately 0.1°C, but this increase does not represent additional physical warming since AR5. "
129881	10	2	10	10	B.2.1 is poorly crafted and requires a complete rewrite. The rather convoluted and confusing lead sentence could be relegated to the end of the paragraph but, without revision, it would be best removed. The lead sentence could be "From 1850-1900 to 2009-2018, GSAT....". Then follow this statement of evidence with the assessment of regional trends over the same time period, "Temperatures have increased faster over land...". The statement of attribution could then follow "The likely range of GSAT due to increases in well-mixed..." This paragraph could then end with a statement about the GSAT changes from 1750 to 1850-1900, though it could be omitted entirely without any loss. [Trigg Talley, United States of America]	Taken into account. Bullet significantly streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
129885	10	2	10	10	Recommend Section B.2.1 summary text be shortened by reducing the references to specific data and instead report general trends in the data. [Trigg Talley, United States of America]	Accepted.
32359	10	2	10	10	How is the first sentence connected to the rest of the paragraph? What is the concrete statement of the first sentence? It seems a bit like "We do not know" and I am not sure that it is best to start the paragraph with such a vague statement. [Clemens Schwingshackl, Norway]	Taken into account. Bullet significantly reorganised, streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.
20343	10	2	10	10	Does one have to keep the 1st sentence, which is contorted et still does not supply any definite information? It acts like a smoke curtain masking the rest of the paragraph B.2.1, which presents valuable findings. [philippe waldteufel, France]	See 23363 and 41295

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68227	10	2	10	10	Include that the rate of warming has increased in recent decades. The rate of global annual temperature increase has more than doubled in recent decades to 0.17 °C per decade. The rate of CO2 concentration in the atmosphere also is accelerating, growing to a rate of 2.48 ppm/year in 2018; for comparison, the average increase of CO2 in the 1980s was about 1.6 ppm/year and 2.2 ppm/year during the last decade (2008–2017). The accelerating warming is being driven not only by continuing emissions, but also by self-reinforcing feedbacks. Xu Y., et al. (2018) Global warming will happen faster than we think, NATURE, Comment 564:30–32; National Oceanic and Atmospheric Administration (NOAA), Global Climate Report - Annual 2018 (last accessed 15 June 2019) (“During the 21st century, the global land and ocean temperature departure from average has reached new record highs five times (2005, 2010, 2014, 2015, and 2016), with three of those being set back-to-back. From 1880 to 1980, a new temperature record was set on average every 13 years; however, for the period 1981–2018, the frequency of a new record has increased on average to once every three years. Nine of the 10 warmest years (listed below) have occurred since 2005, with the last five years (2014–2018) ranking as the five warmest years on record. The year 1998 is the only year from the 20th century among the ten warmest years on record, currently tying with 2009 as the ninth warmest year on record. The yearly global land and ocean temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880; however, the average rate of increase since 1981 (0.17°C / 0.31°F) is more than twice as great.”); National Oceanic and Atmospheric Administration (NOAA), Earth System Research Laboratory Global Monitoring Division, “The NOAA Annual Greenhouse gas index (AGGI)”;	Taken into account. The increase in the rate of warming is mentioned in HS2.2.
34969	10	2	10	10	The SOD indicates that, likely as not, that there was no warmer period since the last Interglacial than the recent decade. Please also see rebuttal comments #1 to #11 above. [Jim O'Brien, Ireland]	Rejected. This interpretation was inconsistent with intended meaning. See also 23363
104091	10	2	10	10	An additional sentence is needed explaining why it is relevant to know how long ago in the past temperature was as high as now. When was the end of the last interglacial maximum? How can that climate state and the current one be compared? [Philippe Tulkens, Belgium]	Noted. Indeed that is what is trying to be stated here but there is a limit to what can be stated in a concise SPM and here the interested reader really needs to dive into the TS and chapter 2 where this detail is given.
104093	10	2	10	10	B2.1, C1.2, Box SPM2 & general comment about temperature metrics and 1.5°C. Changes in temperature since pre-industrial and short-term projections need to be explained more transparently. Readers who are now familiar with the SR1.5 findings (that GMST has increased by 1°C since preindustrial times and warming is likely reach 1.5°C in 2030-2052) need to understand what has changed. A concise explanation is therefore needed of how to understand the combination of improvements in science and data, and the reason for switching back to GSAT. They also need to know how to interpret (and not misinterpret) the 'ten years earlier' finding of Section 4.3.4. Such an explanation could also include an assessment of the degree to which it is scientifically valid to regard 1.5°C as a tipping point for additional warming and positive feedbacks. [Philippe Tulkens, Belgium]	Taken into account. The importance of differences between GSAT and GMST for warming rates is now less than previously thought, so the SPM is expressed in terms of global surface temperature, with an explanation in footnotes 8 and 10 in the final (approved) SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108191	10	2	10	10	“Forcing agents” need to be clearly defined in non-technical language. The role of aerosols (and what they are) need to be explained as well in plain language. [Anton Holland, Canada]	Taken into account. This term no longer appears in the revised SPM.
66723	10	2	10	10	Include that the rate of warming has increased in recent decades. The rate of global annual temperature increase has more than doubled in recent decades to 0.17 °C per decade. The rate of CO2 concentration in the atmosphere also is accelerating, growing to a rate of 2.48 ppm/year in 2018; for comparison, the average increase of CO2 in the 1980s was about 1.6 ppm/year and 2.2 ppm/year during the last decade (2008–2017). The accelerating warming is being driven not only by continuing emissions, but also by self-reinforcing feedbacks. Xu Y., et al. (2018) Global warming will happen faster than we think, NATURE, Comment 564:30–32; National Oceanic and Atmospheric Administration (NOAA), Global Climate Report - Annual 2018 (last accessed 15 June 2019) (“During the 21st century, the global land and ocean temperature departure from average has reached new record highs five times (2005, 2010, 2014, 2015, and 2016), with three of those being set back-to-back. From 1880 to 1980, a new temperature record was set on average every 13 years; however, for the period 1981–2018, the frequency of a new record has increased on average to once every three years. Nine of the 10 warmest years (listed below) have occurred since 2005, with the last five years (2014–2018) ranking as the five warmest years on record. The year 1998 is the only year from the 20th century among the ten warmest years on record, currently tying with 2009 as the ninth warmest year on record. The yearly global land and ocean temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880; however, the average rate of increase since 1981 (0.17°C / 0.31°F) is more than twice as great.”); National Oceanic and Atmospheric Administration (NOAA), Earth System Research Laboratory Global Monitoring Division, “The NOAA Annual Greenhouse gas index (AGGI)”; Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1618481114; Report of the Committee to Prevent Extreme Climate Change (Chairs: V. Ramanathan, M. L. Molina, and D. Zaelke) (2017) Well Under 2 °C: Science-Based Climate Policy for a Sustainable Future	See response to comment number 66227.
5285	10	2	10	10	Move the first sentence to the end of this bullet. Delete the second sentence. What happened before 1900 is not essential to the SPM. [Daniel Murphy, United States of America]	Taken into account. Bullet significantly reorganised, streamlined and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context). The caveat from 1750 has been dropped for the sake of conciseness.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86461	10	2	10	10	GSAT is introduced here. Section A and figure SPM.1 use GMST. Recent reports have used GMST. It is unclear why this change is needed. Using the same as in other recent reports would help with the comparability of the information and understanding the changes from one report to another. If there is a particular reason for switching to GSAT on AR6, then this needs to be carefully explained. SPM should use GSAT or GMST, but not both. Also, the difference between these two is not clear in the glossary - please expand. [Ala Taimar, Estonia]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
69847	10	2	10	10	Consider also the rate of warming has increased in recent decades. The accelerating warming is being driven not only by continuing emissions, but also by self-reinforcing feedbacks. Xu Y., et al. (2018) Global warming will happen faster than we think, NATURE, Comment 564:30–32; National Oceanic and Atmospheric Administration (NOAA), Global Climate Report - Annual 2018 (last accessed 15 June 2019) ("During the 21st century, the global land and ocean temperature departure from average has reached new record highs five times (2005, 2010, 2014, 2015, and 2016), with three of those being set back-to-back. From 1880 to 1980, a new temperature record was set on average every 13 years; however, for the period 1981–2018, the frequency of a new record has increased on average to once every three years. Nine of the 10 warmest years (listed below) have occurred since 2005, with the last five years (2014–2018) ranking as the five warmest years on record. The year 1998 is the only year from the 20th century among the ten warmest years on record, currently tying with 2009 as the ninth warmest year on record. The yearly global land and ocean temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880; however, the average rate of increase since 1981 (0.17°C / 0.31°F) is more than twice as great."); National Oceanic and Atmospheric Administration (NOAA), Earth System Research Laboratory Global Monitoring Division, "The NOAA Annual Greenhouse gas index (AGGI)"; Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sci., doi: 10.1073/pnas.1618481114; Report of the Committee to Prevent Extreme Climate Change (Co-Chairs: Ramanathan V., Molina M. L., and Zaelke D.; Authors: Alex K., Auffhammer M., Bledsoe P., Borgford-Parnell N., Collins W., Croes B., Forman F., Gustafsson Ö., Haines A., Harnish R. Jacobson M. Z., King S., Lawrence M., Leloup D., Lenton T., Morehouse T., Munk W., Piccolotti R., Prather K. Raga G. B., Rignot E., Shindell D., Singh A. K., Steiner A., Thieme M., Titley D. W., Tucker M. E., Tripathi S., Victor D., & Xu Y.) (2017) Well Under 2 Degrees Celsius: Fast Action Required to Protect People and the Planet from	See response to comment number 66227.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112603	10	2	10	10	So what is the level of human-induced warming in 2020, the year from which remaining carbon budgets are calculated? And what is the assessed rate of increase in human-induced warming? These are absolutely fundamental numbers for the global stocktake and are strangely missing from this assessment. The objection that it is impossible to define the level of global warming in a single year is nonsense -- we went over all this in SR1.5 (for consistency with the WMO definition of climate, it is the average temperature of a 30-year period centred on the year in question and, if only part of those 30 years are available, assuming any secular trend in the first half continues into the second half). With global warming proceeding at >0.2C per decade, reporting the "current" level of warming as the average over the past decade understates the current level of warming by at least 0.1C. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Carbon budgets are calculated for 2020 but make use of assessed human-induced warming for 2010-2019 without issue. In AR6, carbon budgets are based on assessed TCRE rather than assessed warming rate. See Table SPM.2.
67811	10	2	10	10	In this section, reference was made to the increase of global surface air temperature (GSAT) due to antropogenic factors, green house emissions from human activities and aerosols. However, the magnitude of this GSAT does not reflect the actual air temperature as perceived by human and other living things. It is suggested to make a prediction or interpolation of the GSAT value for estimating air temperature. Estimation of air temperature can be related to the increase of human activities. In this way, the effect of actual temperature rise on the activities of each sector can be portrayed. There is also a need to give data on GSAT for each land cover, especially to differentiate between vegetation covered area and non-vegetation covered/bare land. [Ruandha Agung Sugardiman, Indonesia]	Taken into account. This section takes a global view of assessed warming, and global surface temperature (either GSAT or GMST, see footnote 8 in the final version) is the correct metric for that view. The SPM makes statements on the impact of climate change on vegetation (HS1.8) and land/ocean contrast (HS1.2, HS6.1).
50153	10	2	10	10	For context, it would be helpful to specify here when the end of the last interglacial period was. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. 125 thousand years ago now mentioned in HS2.2.
50155	10	2	10	10	It might be helpful to specify here that the 1850-1900 is often used as a proxy for pre-1750, to understand why we are comparing these periods in terms of net increase in GSAT due to anthropogenic factors. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Footnote 15 now says: " The multi-century period prior to the onset of large-scale industrial activity around 1750. The reference period 1850–1900 is used to approximate pre-industrial global surface temperature." Note that temperature change between 1750 and 1850-1900 is no longer mentioned in the SPM, for conciseness.
50157	10	2	10	10	Policymakers are likely to compare the temperature increases given in this report with those given in SR1.5. It should therefore be explained very clearly within B2.1 - not just in the definitions - the fact that GSAT is not equivalent to GMST, but that it is a higher figure associated with different uncertainties. It would also be very helpful to briefly explain why in AR6 the preference is to use GSAT vs GMST , and the implications of such a change across the AR6 WGs. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See response to comment number 104093.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
114929	10	2	10	10	It is important for WG3 to establish a line of sight to the update of historic warming estimates relative to AR5 on the SPM level. For this, it would be useful to state the new GSAT estimate for 1986-2005, and compare it with the GMST AR5 estimate for the same period, which is about 0.1°C lower, and summarize the reasons for this update (reference to the Box on surface temperatures). The GMST AR5 estimate remains relevant for the political process as it was used in the AR5 and the UNFCCC Strategic Expert Dialogue (SED) that served as input to the formulation of the Paris Agreement. [Elmar Kriegler, Germany]	Taken into account. Assessment of global surface temperature change for 1986-2005 is given in the caption of final Table SPM.1. See also footnotes 8 and 10 of the final (approved) SPM.
107507	10	2	10	10	Discussion should provide a best estimate of the human contribution to global warming, per Figure SPM.3. Discussion fails to contrast the sum of the natural forcings to the sum of the anthropogenic forcings. This is critically important as the public (and thus policymakers) under-estimate the human contribution to observed warming. [Hunter Cutting, United States of America]	Taken into account, net human-caused surface warming provided in HS1.2
106495	10	2	10	10	Given the massive messaging difference between AR5 warming of 0.87 and AR6 of 1.1, I think this absolutely has to be dealt with in the SPM. My naive suggestion would be to do this in a figure that has curves representing both GMST (so AR5) and GSAT (AR6) and a series of text boxes explaining the drivers of the differences. This is too big a narrative change not to deal with in the SPM and also has direct bearing on WG2 and WG3 messaging. Or at minimum a FAQ should address this. [Lennard Christopher, South Africa]	See response to comment number 104093.
54629	10	2	10	15	The text here rather undermines the text on pg. 4 (lines 22-34 and line 34) which make unequivocal or factual statements about human influence on climate. Here the focus is on changes over particular periods, but the juxtaposition with text in section A may lead to confusion or misunderstanding. This might be ameliorated by reordering the text in B.2.1 and B.2.2 to lead off with high confidence or factual statements, and then add further refinements or sub-sets that have lower confidence. [Nancy Hamzawi, Canada]	Taken into account. The statement has been revised to clarify the role of humans in global temperature rise in HS1.2.
36101	10	2			Way too confusing here. First you compare one decade to averages over many centuries. May be justified, but It looks a bit odd. The second sentence is based on GHG & aerosols, not on observations, put it elsewhere if you must have it. The senetnce on line 6 is also a model result, stop mixing observations and models. Make them separate. Please put explicitly [land] and [ocean] after the land ocaen temp changes so it is clear. Put the model estimates at the end or in a separate bullet (better). [Michael PRATHER, United States of America]	Taken into account. 1) The revised HS2.2 tries to be clearer as to the nature of the comparison being undertaken. 2) Bullet significantly streamlined, reorganised and simplified with the most important information now provided in HS1.2 (warming) and HS2.2 ((pre)historical context).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89907	10	2			The SPM would benefit from better articulating of the reason for the change from GMST to GSAT and why the need to correct the GSAT to GMST in circumstances where the CMIP6 models are improvement in the science and taken as better performing models that CMIP5 models. The SPM would be enriched if greater clarity is provided on the new temperature metric. [Joanne Deoraj, Trinidad and Tobago]	<p>Not applicable.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
99975	10	2			This paragraph comes with a novel temperature metric and a new reference period (1750) that need a lot more framing and explaining. The corrected GMST to GSAT issue is clearly deeply concerning as temperature metric goalposts relevant to the Paris Agreement have have been shifted without keeping a clear pathway to the metrics presented in AR5. This is of grave concern and needs to be addressed in the SPM and in the underlying chapters. [Caroline Eugene, Saint Lucia]	<p>Taken into account</p> <p>Following the SOD review, changes in GSAT and GMST were reassessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p> <p>Re. the new reference period (1750), this part has been removed from the revised SPM.</p>
68797	10	2			A clear line of sight to the metrics presented in AR5 must be kept. Introducing a new temperature metric and reference period must be in keeping with the Paris Agreement. This concern must be addressed in the SPM as well as the underlying chapters [Jeffers Cheryl , Saint Kitts and Nevis]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
97231	10	2			"about as likely as not": Is this due to a lack of knowledge, lack of evidence, lack of agreement? [Nicole Wilke, Germany]	See 23363
117213	10	3	10	3	why "net" increase of global surface air temperature? [Maisa Rojas, Chile]	not applicable. Sentence no longer appears in revised version

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37447	10	3	10	5	Absolutely laughable. There is no accurate global surface air temperature in 1750 (only three weather stations operating and all in Europe) nor is the average global surface air temperature from 1850-1900 of any value whatsoever because annual average global coverage, according to HadCRUT4 dataset, did not exceed 50% until 1904. [John McLean, Australia]	Rejected. Spatial coverage of global surface temperature datasets is discussed in Cross-Chapter Box 2.3 and Section 2.3.1.1.3. Improved coverage (through interpolation) is one of the dataset innovations since AR5. Chapter 2 assesses as extremely likely that interpolation results in a less biased estimate of global surface temperature change. However, that result is not sufficiently notable to be mentioned in the SPM.
110793	10	4	10	4	GSAT spelled here needed? [cathy clerbaux, France]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
86107	10	4	10	9	Could the time reference "1850-1900" be defined once to 'pre-industrial' and thereafter avoided? [Debra Roberts and the Durban WGII TSU, South Africa]	Rejected. Other time periods that are before pre-industrial are also used in this report. Dates are stated for clarity.
80079	10	4	10	9	It should be written that there was no effect for the change between 1750 and 1850-1900 (pre-industrial was defined per se and basically it is a zero change). It is not perfectly correct to compare 10 years of climatology (2009-2018) with the past, please change it to 20 years if possible. Also, define what other anthropogenic forcings are besides aerosol which ends in the negative contribution. [Lilian Fejes, Hungary]	1 - Rejected. This topic is not covered in the SPM as the baseline of 1850-1900 is well established in the IPCC. A thorough assessment can be found in Chapter 1 of the report. 2 - Rejected. Ten year periods have been used in past IPCC reports (e.g. the SR1.5°C). 3 - Taken into account. A detailed breakdown of the different contributors to temperature rise is shown in Figure SPM.2
111449	10	4	10	45	I find this last part hard to understand. Are we saying a decrease in aerosol loading has led to increased surface insolation? If so, it would be good to state this, rather than just "an overall radiative effect of anthropogenic aerosols". [James Renwick, New Zealand]	Taken into account. The text (now HS.1.2) has been revised to clarify to role of aerosols that contribute a cooling effect.
101555	10	4			Change "between 1750 and 1850-1900 is likely" to "between 1750 and 1850-1900 was likely" [Knut Nadelhoffer, United States of America]	Not applicable, sentence removed.
37449	10	5	10	5	Speculative nonsense because, as I noted above for the previous sentence, globally the data coverage was below 50%. You have completely ignored not just coverage but a multitude of other issues that make the historical temperature record unreliable (See McLean (2018) "An Audit of the Creation and Content of the HadCRUT4 Temperature Dataset" and note that the issues that applied prior to the processing for HadCRUT4 almost certainly applied to every historical temperature dataset because they all share the same data.) [John McLean, Australia]	Rejected. Those issues are assessed in Chapter 2 but do not require a mention in the SPM.
27797	10	5	10	5	Please specify the certainty level for the figure given here. [Eric Brun, France]	Accepted. Certainty level specified with square bracket and footnote 8 in HS1.2 of the revised SPM.
86939	10	5	10	5	With respect to the goal under the Paris Agreement this finding, regarding temperature increase (GSAT or GMST) since 1850-1900 to recent times, should be lifted to the highlighted conclusion B.2. [Oyvind Christophersen, Norway]	Not applicable. With revised structure and narrative of the SPM, it does not really make sense to elevate this number.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86941	10	5	10	5	With respect to the 1.1 degree temperature increase, there are useful information about how this re-assessment relates to the temperature goals of the Paris Agreement in section 2.3.1.1.3. Please consider including relevant information into the SPM and the TS. Here it is mentioned as GSAT, while in the Figure SPM.1 caption p. 5 and p. 45 it is stated that GMST increased by 1.1 degree. Please check for consistency. [Oyvind Christophersen, Norway]	Not applicable. Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
86463	10	5	10	5	The stated GSAT increase by 1.1C needs to say whether it is caused by antropogenic factors. We presume so. Previously we knew that global warming has been 1C. Why is there now an increase by 0.1C? This needs to be explained. [Ala Taimar, Estonia]	Taken into account. It has been clarified that this is human-induced warming. See also response to comment number 104093.
97233	10	5	10	5	From 1850-1900 to 2009-2018, GSAT increased by 1.10°C (0.97° – 1.25°C). Maybe add a footnote explaining the reasons for this difference from the 0.87 °C provided in the SRCCL. [Nicole Wilke, Germany]	See response to comment number 104093.
87255	10	5	10	5	The assessed increase in surface air temperature is higher than in previous reports (even if comparing the same periods). Only a fraction of the difference can be explained by the new concept GSAT instead of GMST (about 0.04C). The largest difference of about 0.1C is due to dataset innovations and new products according to TS (p.23 l.56 - p.24 l.2) referring to Ch.2 (p.36 l.27 - p.36 l.31). This is a very policy relevant statement, as it brings us in fact closer to 1.5C. The explanation should be summerized in the SPM and in the TS and Chapter 2 (summary) as well (now missing). It is by far not clear whether the reassessment or innovations of global surface air temperatures are in ocean temperatures or in land temperatures (or both). So, please make also better descriptions in the text of Chapter.2 in section 2.3.1.1.3. [Marcel Berk, Netherlands]	See response to comment number 104093.
107983	10	5	10	6	Use of a single decade for the recent period in the delta-GSAT value is a balance between having too short a period that is more strongly affected by internal variability and having too long a period that does not fully capture the warming we have actually reached in 2018 (or 2019, 2020 if updated). I think this has the balance about right and suggestions to lengthen the period should be resisted for these reasons. An alternative that might reduce the effect of internal variability might be to smooth the record through to its ends (e.g. a loess smooth) and take the final point of the smoothed curve as the warming reach by 2018. However that introduces its own uncertainties due to end effects on the smoothed series. So I'd support sticking with the use of a 10-year mean as currently used (or updated to 2010-2019 or 2011-2020). [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
32361	10	5	10	8	Do the estimates of the contributions of greenhouse gases and aerosols sum up to the total GSAT change? If not, what are the remaining components? [Clemens Schwingshackl, Norway]	Taken into account. A detailed breakdown of the different contributors to temperature rise is shown in Figure SPM.2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42609	10	5	10	8	Is the likely range of GSAT warming that is described according to model simulations during the same period as the observations or a prediction for up until 2050 or 2100? The meaning of the statement is unclear. [Sofie Schöld, Sweden]	Taken into account. The statement has been revised to clarify. A detailed breakdown of the different contributors to temperature rise is shown in Figure SPM.2.
90755	10	5	10	8	The message contained in this sentence is very policy-relevant and should be expressed clearly. It does not present the "net human influence" (terms used in Fig. SPM.3) (well-mixed greenhouse gases and aerosols and other anthropogenic forcings) warming (expressed by GSAT)? Does it mean that global warming is already beyond 1.5 degrees? This question needs a clear answer due to its policy-relevance. [José Romero, Switzerland]	Taken into account. The statement has been revised to clarify meaning. A detailed breakdown of the different contributors to temperature rise is shown in Figure SPM.2.
86565	10	5	10	10	Issue with GSAT vs GMST. I assume your report global GSAT here, estimated as observed GMST*1.04. But then the warming over land and warming over ocean are taken from observed fields (ie not multiplied by the inflating factor). Again, this is opaque and confusing. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
25795	10	6	10	6	It could be useful to define "well-mixed greenhouse gases" the first time it is used in the text. [Don Alfonso Pino Maeso, Spain]	Noted. Well-mixed greenhouse gas is defined in the glossary.
27799	10	6	10	8	Is the sum of these two components the resulting GSAT warming? This is not clear. [Eric Brun, France]	Taken into account. It has been clarified in HS1.3 that the balance is between GHG and "other drivers". See also Figure SPM.2.
44717	10	6	10	8	Over which period? (Since 1750 or since 1850-1900?) [Markku Rummukainen, Sweden]	Taken into account. Clarified. As 1750 no longer mentioned, it is now clear that we are talking about 1950-1900.
25793	10	6	10	8	Please specify period, its is implied that the period is from 1850-1900 to 2009-2018 [Don Alfonso Pino Maeso, Spain]	Taken into account. Clarified. As 1750 no longer mentioned, it is now clear that we are talking about 1950-1900.
69341	10	6	10	8	Regarding changes in GSAT due to well-mixed greenhouse gases from human activities, as well as those from aerosols and other anthropogenic forcing, it would be better to add estimated values of change such as mean or median as in I.5 and I.9-10 of B2.1. [Kaoru Magosaki, Japan]	Taken into account. A best estimate for overall warming has been added, but for the sake of clarity and consistency with underlying chapters, attribution to specific forcing is only given as uncertainty ranges.
14559	10	6	10	8	Suggest to delete this sentence. Detracts from the main message. [Roshanka Ranasinghe, Netherlands]	Rejected. It has been kept as we think it is an important piece of information.
71327	10	6	10	10	Consider using the word "to" rather than a dash in expressing ranges of temperature, to remove any ambiguities between the dash and a minus sign. (e.g. "-0.7 to 0.2°C" rather than "-0.7 –0.2°C") [David Wratt, New Zealand]	Accepted. The word 'to' is used in HS1.2
17455	10	6			Does 'well-mixed' greenhouse gases need to be explained? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Well-mixed greenhouse gas is defined in the glossary.
41297	10	7	10	7	It may be confusing to read another GSAT range following the previous GSAT range. Here, it should be made more clear that these following two ranges combined would yield the total 0.97-1.25 degC (correct?). Maybe sth along the following lines: "If split into well mixed GHGs from human activities and aerosol as well as other anthropogenic contributions, the likely GSAT ranges would be 0.9-2.0 degC and -0.7-0.2 degC, respectively." [Alexander Nauels, Germany]	Taken into account. All components are now clearly listed. See also Figure SPM.2.
89651	10	7	10	8	Need to be explicit here about what the "other anthropogenic forcings" are [Trude Storelvmo, Norway]	Accepted. 'principally aerosols' added in HS1.2

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25797	10	8	10	8	Please specify whether "temperatures" refer to GSAT. [Don Alfonso Pino Maeso, Spain]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
109305	10	8	10	8	Are both numbers in the aerosol range statement negative? Not sure how to make this clear typographically, but if so, one could write: "anthropogenic forcings is between -0.7°C and -0.2°C." Please clarify. [Paul Edwards, United States of America]	Taken into account. The text now refers to a cooling to avoid the issue with sign.
27801	10	8	10	9	Please double check this figure, as GSAT over land is smaller than the one reported in SRCCL (+1.53°C) for the period 2006-2015. [Eric Brun, France]	Agreed. Figure has been corrected to +1.59C.
37451	10	8	10	10	Differences in land and sea temperatures should be ignored for periods with low data coverage (i.e. all of 1850-1900) because global average temperature anomalies are far too uncertain. The reality is that the land and sea temperature anomalies diverge after 1980, having been very similar for the previous 65 years. There are many possible reasons why one or both sets of data might be incorrect since 1980 and even if both set sof data were correct there are reasons, such as a reduction on cloud cover, why land might warm more than the oceans. [John McLean, Australia]	Rejected. The physical reasons behind enhanced warming of land are well understood. See also answer to comment number 37447.
129891	10	8	10	10	Is "1.44°C" for land and "0.89°C" for ocean? If so, rewrite the sentence to read "...0.89°C, respectively" to make this point clear for the reader. [Trigg Talley, United States of America]	Agreed. The statement has been clarified in HS1.3.
32363	10	8	10	10	The values 1.44°C and 0.89°C should be connected more clearly to land and ocean, maybe by writing "0.44°C over land,... 0.89°C over the ocean". [Clemens Schwingshackl, Norway]	Agreed. The statement has been clarified in HS1.3.
130445	10	8	10	10	The confidence on attribtion of East Asia monsson change is too high. [Panmao Zhai, China]	Not applicable. Sentence is not about monsoon but temperature change.
97235	10	8	10	10	Temperatures have increased faster over land than over the ocean: please explain what is meant by "over ocean": SST or near-surface temperature over oceans? Please see also our comment on the SST in the glossary. [Nicole Wilke, Germany]	See response to comment number 104093.
97237	10	8	10	10	The time periods described here do not match those in Figure SPM.5. Please revise consistently. [Nicole Wilke, Germany]	Rejected. The old figure SPM.5 has been removed.
110795	10	9	10	10	of 1.44°C over land...versus 0.89°C over sea [cathy clerbau, France]	See response to comment number 32363.
37453	10	10	10	10	None of the figures that you refer to, SPM.3, SPM.4 or SPM.5, support the arguments that you present in this paragraph. [John McLean, Australia]	Taken into account, HS1.2 and HS2.2 are now supported by the new figures SPM.1 and SPM.2

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37463	10	11	10	15	Figure SPM.3 assumes that the output of models is correct but those models have never been validated so your figure is mere speculation. I also remind you that AR5 said of the discrepancy between the temperature trends that models predicted and the lower trends derived from observations (a) "There may also be a contribution from forcing inadequacies and, in some models, an overestimate of the response to increasing greenhouse gas and other anthropogenic forcing (dominated by the effects of aerosols)." [WG I SPM, section D.1, page 15, bullet point 2, and in full Synthesis Report on page SYR-8] and (b) "This difference between simulated [i.e. model output] and observed trends could be caused by some combination of (a) internal climate variability, (b) missing or incorrect radiative forcing and (c) model response error". [WGI contribution, chapter 9, text box 9.2, page 769]. [John McLean, Australia]	Taken into account. Causes of difference are assessed in Chapters 3,4 and 7. SPM3 does not assume models are correct.
37465	10	11	10	15	Figure SPM.3 is flawed because it concatenates two very different records of greenhouse gases, which any competent scientist knows should not be done [John McLean, Australia]	Rejected. Figure no longer shown, but there is strong basis for presented time series
37467	10	11	10	15	Figure SPM.3 is flawed because the temperature data that it uses (which is from an unspecified source) seems to think that global average surface air temperature can be calculated to three decimal places even prior to 1904 when HadCRUT4 coverage was less than 50%. [John McLean, Australia]	Rejected. The data in the plot are not given to the precision stated in the comment. The datasets used were also comprehensively revised in the FGD and benefit from improved data quality and sampling completeness
37469	10	11	10	15	It is dishonest to claim that the Y-axis is a change in "global surface temperature" when no such thing can be determined because global coverage is far too low to enable such a calculation. [John McLean, Australia]	Rejected. This has precedent in the literature and prior assessment reports and is scientifically appropriate
37471	10	11	10	15	Temperatures relative to 1850-1900 are nonsense because of low and inhomogenous coverage during that time. From January 1850 to June 1852 a single weather station provided the only land-based temperature data for the southern hemisphere. During the 1860s and 1870s in particular, Europe and the North Atlantic provided a far greater proportion of Northern Hemisphere data than the proportion of the NH surface area that it occupies. At time this region, about 12% of the NH, accounted for more than 70% of the NH coverage. Worse, Europe was just emerging from the Little Ice Age at the time and conditions were still quite cold. During the same decades, coverage in the Southern Hemisphere was dominated by the shipping routes from Europe to S-E Asia. In 45 of the 96 months from 1861-68 inclusive that area accounted for more than 70% of SH coverage. All this is discussed in section 4.5 of McLean (2018) "An Audit of the Creation and Content of the HadCRUT4 Temperature Dataset" (undertaken because the IPCC has used the tempeerature data for 30 years and never audited it). [John McLean, Australia]	Rejected. There are more data than implied here incorporated in the new data products assessed in AR6. In addition and as assessed in the underlying report there are improved techniques to interpolate into data sparse regions enabling more globally representative estimates. There are also now several datasets going back to 1850 increasing the assessment robustness.
93741	10	12	10	12	Is it possible to make a confidence statement about the warming of the troposphere? [Quentin Lejeune, Germany]	Agreed. Confidence statement is now in A1.3. Note that tropospheric/stratospheric temperature changes are now discussed in the context of attribution.
78657	10	12	10	12	"troposphere has warmed since the 1950s," - Can a certainty be given for this statement? Or at least add where this is discussed / cited in the main document. [Heike Wex, Germany]	See response to comment number 93741.
37455	10	12	10	12	How can a measured value have any uncertainty? It's like trying to say that someone is "a little bit pregnant". [John McLean, Australia]	Rejected. All observations have some uncertainty associated with them, as such quantified uncertainty ranges are included where appropriate.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129895	10	12	10	12	Why is it that there is a likelihood statement attached to stratospheric cooling but not to tropospheric warming? Both should have a likelihood and confidence statement. [Trigg Talley, United States of America]	See response to comment number 93741.
131701	10	12	10	13	include a brief description of troposphere and stratosphere, either as part of the sentence or as footnote [Hans Poertner and WGII TSU, Germany]	Rejected. Those concepts are well known now, especially for the stratosphere in the context of ozone depletion.
77005	10	12	10	19	The troposphere may not be fully understood by policy. What is the message? [Emer Griffin, Ireland]	See responses to comment numbers 131701 and 84703.
77007	10	12	10	19	Ozone is a key GHG. Its loss from the upper atmosphere (stratospheres) caused this part of the atmosphere to cool. This is now reversing. [Emer Griffin, Ireland]	Noted. The statement already makes reference to ozone depletion.
77009	10	12	10	19	Tropical belt may be obscure for policy. Some narrative around this is needed. [Emer Griffin, Ireland]	Taken into account. The term 'tropical belt' is no longer mentioned in the revised SPM.
84703	10	12	10	19	do we have numbers/estimates for this warming/cooling of the troposphere/stratosphere? [Annalisa Cherchi, Italy]	Rejected. The warming profile is complex and averaging over troposphere and stratosphere would not be very enlightening. The message here is more about the vertical structure of warming, which is consistent with greenhouse gas forcing, although ozone depletion and recovery complicates the interpretation of stratospheric trends.
50159	10	12	10	19	Given that the headline B2 statement discusses warming since 1850-1900, it would be helpful if B2.2 could clarify whether we know that the troposphere did not warm in the first half of the century, or if we just lack the observations to confirm this. Adding 'at least' to 'The troposphere has warmed since at least the 1950s' could help resolve this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. It would not be appropriate to speculate on trends before data is available.
36103	10	12			B.2.2 is solid and clear. But here you have made an attribution to human GHGs whereas in B.2.1 you just give a likely range of what we model. Please put a parallel attribution in B.2.1 or take it out of here. [Michael PRATHER, United States of America]	Taken into account. Attribution of tropospheric and stratospheric temperature change has been clarified in HS1.3.
129893	10	12			Revise to say, "It is certain that the troposphere has warmed since the 1950s, and it is virtually certain that the stratosphere..." [Trigg Talley, United States of America]	See response to comment number 93741.
111101	10	12			no uncertainty language for troposphere but for stratosphere? [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	See response to comment number 93741.
82529	10	13	10	13	This wording implies that the new satellite techniques (a reference to radio occultation) are the only contributor to this finding, when in fact they strengthen evidence from other sources (MSU, radiosondes, reanalyses) and thus result in increased confidence in this finding relative to AR5. [Blair Trewin, Australia]	Noted. That statement has been removed, and tropospheric/stratospheric temperature changes are only discussed in the context of attribution.
129897	10	13	10	14	Section B.2.2 is about global conditions. The intersection of a statement about tropical conditions alone in the second sentence is therefore a bit jarring and confusing. Since all the remaining statements appear to refer to global conditions again, it is best for clarity to remove the sentence beginning "In the tropics, new satellite..." [Trigg Talley, United States of America]	Noted. That statement has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6355	10	13	10	14	The sentence that spans these lines could be misinterpreted. I believe it to be referring to one new type of satellite measurement available since about 2001 that has raised the degree of confidence that the atmosphere has warmed faster in the upper troposphere than near the ground. But there is evidence directly from observations and from the reanalyses produced by processing them, that the upper troposphere was warming faster than the near-surface before 2001 also. See also comment 76 on Chapter 2. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Noted. That statement has been removed.
6357	10	15	10	16	Is "since the start of comprehensive satellite observations" needed here? Could the text not read "since the 1970s"? Or at least change "since" to "observed from" and insert "the" before "warming". The reference to satellite observations could be misleading, as the radiosonde data show warming also. Again, confidence is higher when one has both types of data. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Noted. That statement has been removed.
27803	10	16	10	16	After "satellite observations", please precise "in 1979". [Eric Brun, France]	Taken into account. Statements now only refer to 1979.
89653	10	16	10	17	This needs clarification - the relative importance of GHGs vs. ozone for temperature trends at different levels in the stratosphere must be discussed. This is important because stratospheric cooling is part of the "fingerprinting" of GHG-driven warming, but this statement reads as if stratospheric cooling was all because of ozone depletion, which is not accurate. ~2/3 of mid/upper stratospheric cooling was due to GHG increases according to 3.3.1. [Trude Storelvmo, Norway]	Taken into account. The amount of detail that can be given is limited. Attribution of tropospheric and stratospheric temperature change has been clarified in HS1.3, in terms of "main drivers".
88891	10	16	10	17	Please explain that also increasing CO2 leads to stratospheric cooling. I would expect cooling to continue after the ozone depletion settles, so it would be good to explain that there are more drivers. [Thorsten Mauritsen, Sweden]	See response to comment number 89653.
27805	10	17	10	17	This indirectly implies that the depletion in stratospheric ozone is responsible for the stratospheric cooling. Is it correct? [Eric Brun, France]	See response to comment number 89653.
129899	10	17	10	19	This sentence makes it sound like, because the stratospheric cooling has stopped, the human influence has stopped. Increased CO2 in the stratosphere would cause cooling, but stratospheric ozone recovery would cause warming, leading to smaller net stratospheric temperature trends (see Maycock et al. 2018, https://doi.org/10.1029/2018GL078035). [Trigg Talley, United States of America]	See response to comment number 89653.
35263	10	17	10	19	Too bad the unprescribed models still insist the stratosphere is strongly cooling. See me reviewer comment #1. [patrick Michaels, United States of America]	Rejected. Differences between models and observations are covered in Chapter 3 (section 3.3.1.2) and are not as bad as the reviewer suggests. That level of detail is not appropriate for the SPM.
25799	10	17	10	19	It would be more coherent to move at the beginning of this sentence the reference to the cooling of the stratosphere contained in the first sentence. Thus, this last sentence would read: "It is virtually certain that the stratosphere has cooled. Most data sets show that lower stratospheric temperatures have stabilized since mid-1990s, with no significant cooling over the last 20 years (medium confidence)." [Don Alfonso Pino Maeso, Spain]	Noted. That statement has been deleted.
107979	10	17	10	19	the comment about stabilised lower strat temperatures since mid-1990s would be made more relevant by linking it with the previous sentence about ozone depletion, which also stabilised, and adding an assessment of upper strat temperature change (which might be expected to continue GHG-induced cooling, so an important indicator to confirm our understanding). [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted. That statement has been deleted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44719	10	18	10	19	Is this in line with the reduced ozone depletion? What does "most data sets" mean? [Markku Rummukainen , Sweden]	Noted. That statement has been deleted.
111637	10	21	10	21	I know meteorologists use the term 'tropics' to mean something other than the tropics, but this term will be confusing to everyone else. The tropics don't change unless the earth's orbital parameters change. Suggest replacing with a more precise and widely understood term. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. This is the case for the first sentence in B2.3 where the word "tropics" was used. "Tropics" referred to Hadley+Walker cells whose assessment is too technical at the SPM level. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
27807	10	21	10	21	The meaning of "tropical belt" in a climatological way should be explained in glossary. [Eric Brun, France]	Partially taken into account. Tropical belt appears in the glossary under East Asian Monsoon although there is no focused entry for this term.
129901	10	21	10	22	The term "tropical belt" is confusing here. How can the tropical belt intensify? Presumably the text is referring to the Hadley circulation. [Trigg Talley, United States of America]	Taken into account. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. This is the case for the second sentence in B2.3 where the word "tropical belt" was used. "Tropical belt" referred to Hadley cells whose assessment is too technical at the SPM level. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
45211	10	21	10	22	"The tropical belt has very likely widened and intensified". While the widening of the tropical belt is consistent with Chapter 8, there is inconsistency with regard to its "intensification" and the low confidence in assessment of changes in strength of the Hadley cell {8.3.2.2}. [Krishnan Raghavan, India]	Noted. In the revised version, headline statements are now much simpler and shorter to provide a high level summary of the SPM. Assessments with medium-to-high level of confidence were preferably retained in the FGD version for sake of simplicity and focus. The intensification of the Hadley cell falls in the "low confidence" category. In any case, Hadley cell assessments for both south and north branches have been considered as too technical and are now omitted in the revised version.
44721	10	21	10	24	What applies in the northern hemisphere? Is there no poleward expansion/other factors/other significance level? [Markku Rummukainen , Sweden]	Noted. In the revised version, headline statements are now much simpler and shorter to provide a high level summary of the SPM. Assessments with medium-to-high level of confidence were preferably retained in the FGD version for sake of simplicity and focus and attribution studies for the northern hemisphere extension of the Hadley cell falls in the "low confidence" category. In any case, assessments on Hadley cell changes for both south and north branches have been considered as too technical and are now omitted in the revised version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
110797	10	21	10	27	this bullet could be shortened [cathy clerbaux, France]	Taken into account. In the revised version, headline statements are now much simpler and shorter to provide a high level summary of the SPM.
50161	10	21	10	27	A policymaker may not understand what the 'tropical belt' is, please could you define this here? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. This is the case for the second sentence in B2.3 where the word "tropical belt" was used. "Tropical belt" referred to Hadley cells whose assessment is too technical at the SPM level. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
42647	10	21			Can a sentence be included on the attribution of the northern hemisphere expansion? Even if there are no conclusive studies it will be useful if this is indicated. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Noted. In the revised version, headline statements are now much simpler and shorter to provide a high level summary of the SPM. Assessments with medium-to-high level of confidence were preferably retained in the FGD version for sake of simplicity and focus and attribution studies for the northern hemisphere extension of the Hadley cell falls in the "low confidence" category. In any case, assessments on Hadley cell changes for both south and north branches have been considered as too technical and are now omitted in the revised version.
111103	10	21			B.2.3 nice section; the timeline is short it would benefit from linking to the question if this change is unusual or not in the longer context. The widening trpics for example is on the background of longterm variability. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. "Tropical belt" referred to Hadley cells whose assessment has been ranked as too technical at the SPM level and are omitted in the revised version. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
67643	10	22	10	22	What does it mean that the tropical belt has "intensified". The belt is a geographic area, it can widen, but it can't intensify. Convection, or transport within the tropkcal belt can intensify, but the belt can't. Perhaps you mean that circulation withing the Hadley cell has intensified. [Karen Rosenlof, United States of America]	Noted. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. "Tropical belt" referred to Hadley cells whose assessment has been ranked as too technical at the SPM level, and is no longer included. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27809	10	22	10	22	It is impossible for policymakers to guess what this intensification means. Few explanations in footnote should be added. [Eric Brun, France]	Noted. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. "Tropical belt" referred to Hadley cells whose assessment has been ranked as too technical at the SPM level and are omitted in the revised version. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
27811	10	22	10	26	Because there is no reference about Northern Hemisphere here (just a little sentence at the end uncorrelated with information on southern hemisphere), policymakers could conclude that shift in tropical belt is limited to Southern Hemisphere, which is not the case. Thus, this part of the text should be completed. [Eric Brun, France]	Noted. In the revised version, headline statements are now much simpler and shorter to provide a high level summary of the SPM. Assessments with medium-to-high level of confidence were preferably retained in the FGD version for sake of simplicity and focus. The intensification of the Hadley cell falls in the "low confidence" category. In any case, Hadley cell assessments for both south and north branches have been considered as too technical and are now omitted in the revised version.
37473	10	22	10	32	It's no surprise and completely meaningless that five datasets approximately agree when they draw on the same source data. The issue that you don't address here or in 2.3.1 is whether that source data is correct. Chapters 8 and 9 of McLean (2018) "An Audit of the Creation and Content of the HadCRUT4 Temperature Dataset" discuss 20 issues about the uncertainty of both sea surface temperatures and temperatures over land prior to any processing for the HadCRUT4 dataset. Of particular interest is that most adjustments of land-based temperature data apply to situations that "corrected" increasing non-meteorological distortion of recorded temperatures (e.g. increasing urbanisation, growth of nearby vegetation, replacement of deteriorated screens). The methods of adjustment recommended by the WMO, or methods derived from them or similar to the, ignore that the distortions changed over time and falsely apply a constant adjustment to all historical data, meaning that while the most recent data might be correctly adjusted earlier data is excessively adjusted. This incorrect form of adjustment also retains, rather than removes, any trend caused by those increasing distortions, just as the "Berkley Earth" dataset explicitly does. [John McLean, Australia]	Not applicable here. Comments refers to temperatures and datasets used to evaluate their variability. Neither B2.3 nor B2.4 assess temperature changes but describe instead changes in atmospheric circulation (B2.3) and water cycle (B2.4).
37475	10	22	10	32	Figure SPM.4(b) is nonsense because no global average temperature can be determined for 1850-1900 when global coverage was less than 50%. (See also above comments about Figure SPM.3.) This has implications for both the X and Y axes. [John McLean, Australia]	No applicable here. Comments refers to temperatures used to evaluate their variability. Neither B2.3 nor B2.4 assess temperature changes but describe instead changes in atmospheric circulation (B2.3) and water cycle (B2.4).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129903	10	22			While the tropical belt can widen, it can't intensify. Simply state that "The tropical belt has very likely widened." If the intensification refers to the Hadley circulation, then a new sentence could be added. [Trigg Talley, United States of America]	Noted. The bullet has been completely rewritten and is now more focused. General sentences and conclusions less relevant for policy-makers have been deleted. "Tropical belt" referred to Hadley cells whose assessment has been ranked as too technical at the SPM level and are omitted in the revised version. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM.
18715	10	24	10	24	"Extratropical storm tracks have likely shifted poleward" Is this true for both hemispheres? [Govindasamy Bala, India]	Noted. Yes, it is true for both hemispheres but the attribution of the shift to human influence is robust only for the southern hemisphere as mentioned in the bullet.
129905	10	24	10	26	While stratospheric ozone depletion's influence on the Southern Hemisphere jet occurs in austral summer, greenhouse gases should have an influence on the jet during all seasons, not just summer (see Figure 13 of Polvani et al., 2011; https://journals.ametsoc.org/doi/full/10.1175/2010JCLI3772.1). [Trigg Talley, United States of America]	Noted. It does but the level of noise (internal variability) is higher in winter than in summer and human-caused influence is therefore not-detectable, except for summer where the signal to noise ratio is higher compared to other seasons. This is why our statement is limited to summer here at the SPM level.
89817	10	24			The statement about extratropical storm tracks needs to be clarified; as written it appears to apply to all seasons in both hemispheres. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The statement has been revised accordingly. Seasons and hemispheres are now explicitly mentioned.
27813	10	25	10	25	We suggest to specify that ozone depletion is human-induced too. [Eric Brun, France]	Noted. For the sake of simplicity, the effects of the anthropogenic forcings taken individually (GHG, O3, etc.) are not specifically addressed in the revised version. All are gathered under the term "human influence".
9489	10	26	10	26	Suggest rephrasing 'Southern Hemisphere jet in austral summer' with 'Southern Hemisphere storm tracks in the austral summer and autumn' in line with executive summary statement reported in chapter 8. [Joelle Joelle Gergis, Australia]	Taken into account. The new sentence assesses both the changes in precipitation/storm tracks (first part) and in the position of the jet (second part of the sentence). We focus here on austral summer, based on the attribution assessment in Chapter 3.
53465	10	27			stratospheric polar vortex (although this last sentence may be not so much policy relevant?) [Hervé Douville, France]	Accepted. Sentence/assessment removed.
27815	10	29	10	30	Please explain why, and if the change is consistent with what would be expected from temperature/atmospheric circulation changes. [Eric Brun, France]	Taken into account. The statement on observed changes in specific humidity has been replaced with a statement attributing changes in atmospheric moisture to human influence in H.S.1.4. Insufficient space was available to go into more detail on the mechanisms driving the change, but they are described in detail in Chapter 8 of the underlying report.
53467	10	29	10	30	Misleading statement suggesting that the increase could be stronger over land while there was a decrease in near-surface RH over land since the late 1990s. [Hervé Douville, France]	Taken into account. This statement has been replaced with a general attribution statement for atmospheric moisture, which does not distinguish between land and ocean.
81885	10	29	10	31	Reorder the paragraph so that land precipitation changes is first. Policymakers are less likely to be concerned about near-surface specific humidity [Dan Zwartz, New Zealand]	Rejected. We discuss changes in humidity first because this variable is most directly influenced by human-induced warming.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111639	10	29	10	36	Suggest also including some information here on precip over the ocean (linking to P12 L9-12) [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. In the revised version, headline statements are shorter and focussed on the most-policy relevant variables, so information on precipitation change over oceans could not be added. Note that we do include information on changes in ocean salinity, which are related to precipitation change, in the revised bullet (H.S.1.4).
129909	10	29	10	37	B 2.4 should also feature the strong signals from salinity changes: fresh get fresher, salty get saltier. See especially Cheng et al (2020) submitted. [Trigg Talley, United States of America]	Taken into account. The revised bullet (H.S.1.4) includes an attribution assessment for changes in ocean salinity.
111501	10	29	10	37	Is it worth saying something here about relative humidity changes? This is the most striking difference between ocean and land surfaces, and ties in better to the key messages from Chapter 8. [James Renwick, New Zealand]	Rejected. In the revised version, headline statements are shorter and focussed on the most-policy relevant variables, so information on relative humidity changes could not be added.
34971	10	29	10	37	The SOD claims large-scale precipitation changes since 1950. Please see rebuttal comment #12 above. [Jim O'Brien, Ireland]	Noted. The statement on changes in global mean precipitation is consistent with the assessment in Chapter 2.
42211	10	29	10	37	B2.4: Very technical terms - potential evaporation and specific humidity. Could a more general statement be made? [Tina Christensen, Denmark]	Taken into account. These terms are not included in the revised bullet (H.S.1.4).
50167	10	29	10	37	The final sentence of B2.4 is taken from the executive summary of chapter 11, and thus section 11.6 should be included in the line of sight here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This sentence has been removed in the interest of brevity.
129907	10	29			Edit to read "Near-surface specific humidity (a measure of the mass of atmospheric water vapor) has likely..." [Trigg Talley, United States of America]	Taken into account. Revised text (H.S.1.4) refers to 'increases in atmospheric moisture'.
25801	10	30	10	31	It would be useful to qualify as low confidence the increase of humidity over oceans in accordance with chapter 2, page 46 lines 8-10: "In summary, observations since the 1970s show a very likely increase in near surface specific humidity over land, but low confidence regarding the increase over the oceans due to discrepancies between data products and between measurement techniques" [Don Alfonso Pino Maeso, Spain]	Not applicable. This sentence has been removed in the revised version of this bullet.
41809	10	31	10	31	Here it is relevant to indicate that relative humidity has dominantly decreased as it is recorded in the TSU [Sergio Vicente-Serrano, Spain]	Rejected. Space considerations mean that such detail cannot be given in the SPM. The detail is available in the TS and the underlying chapters.
129911	10	31	10	32	It is unclear if this statement of attribution refers to the specific observed increase in land precipitation that is mentioned in the immediately prior sentence. If so, then revise to read "It is likely that human influence has contributed to global land precipitation increase since 1950." [Trigg Talley, United States of America]	Taken into account. Sentence has been edited for clarity along the lines suggested here
25803	10	31	10	32	It would be useful to add at this end of the sentence the following sentence contained in Chapter 2 page 48 lines: "A faster increase in global precipitation was observed since the 1990s (medium confidence), with large interannual variability and regional heterogeneity". [Don Alfonso Pino Maeso, Spain]	Taken into account. The aspect of faster increase has been incorporated in revision. The regional aspects and variability aspects are better handled elsewhere within the SPM.
37457	10	31	10	35	On the contrary, wouldn't you agree that an increase in humidity will cause warming? It doesn't require higher temperatures to cause an increase in evaporation. Winds are well-known for causing evaporation and over the oceans the humidity can be greatly influenced by sea surface conditions. [John McLean, Australia]	Noted. This comment refers to attribution statements on changes in the global pattern of precipitation, changes in precipitation in the wet regions of the tropics and changes in precipitation in the Southern Hemisphere. Underlying assessment supporting these statements is provided in Section 3.3.2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
35265	10	32	10	35	Can you cite actual precipitation data from, say, Brazil and Southern Ocean (which exists) to support this claim: "There is medium confidence 33 that rainfall over the wet regions of the tropics has increased due to enhanced greenhouse gas forcing 34 and that ozone depletion has increased precipitation over the Southern Ocean and decreased it over 35 southern midlatitudes during austral summer."and that the changes are statistically significant? [patrick Michaels, United States of America]	Not applicable. This text has been removed to meet stipulated length requirements. Regional detail is given in later subsections as part of this reorganisation.
25805	10	32	10	35	It would be useful to add at this end of the sentence the following sentence contained in Chapter 3 page 5 lines 8-10: "Yet, there is also growing evidence and medium confidence that this tropical precipitation increase has been partly muted by anthropogenic aerosols through a decreasing effect in the Northern Hemisphere summer monsoon region from the mid to late 20th century." [Don Alfonso Pino Maeso, Spain]	Rejected. This level of requested detail is not commensurate with requirement given for a 10 page SPM in FGD.
111105	10	33			B.2.4. would benefit from a link to salinity which records the same process [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Salinity is linked in the revised HS1.4
53469	10	33			of the wet tropics and of the northern high latitudes [Hervé Douville, France]	Not applicable. Text removed as part of efforts to keep to a short 10-page SPM
20345	10	34	10	34	Understanding the driving role assigned here to ozone depletion in modulating precipitation is not straightforward. A reference to the place where this mechanism is discussed in the body of the report would be most welcome [philippe waldteufel, France]	Not applicable. Passage removed and text simplified. This detail no longer present.
27817	10	34	10	34	Please specify if the ozone depletion is stratospheric, tropospheric, or both. [Eric Brun, France]	See 20345
27819	10	34	10	34	The link between ozone depletion and rainfall is certainly not straightforward and may need some explanation. [Eric Brun, France]	See 20345
29397	10	34	10	34	The link between ozone depletion and precipitation change is not clearly presented here. [Joachim Fallmann, Germany]	See 20345
44723	10	35	10	36	It would be good to explain what this means, why it is important. Drought-like conditions? [Markku Rummukainen, Sweden]	See 20345
25807	10	35	10	36	It would be useful to specify the time frame as well as the regions and seasons mentioned in this sentence. [Don Alfonso Pino Maeso, Spain]	See 20345
108243	10	35	10	36	The statement would be much more relevant if the regions/seasons could be named. [Johannes Quaas, Germany]	See 20345
50163	10	35	10	36	'There is medium confidence that trends in potential evaporation have exceeded trends in precipitation in some regions and seasons' - this statement would be more meaningful if it clarified if this means evaporation has exceeded precipitation in some regions, and the reasons for its importance should be stated (i.e. water availability, increased risk of drought). A possible solution could be editing so that it reads "There is medium confidence that evaporation has exceeded precipitation in some regions" if this still retains scientific accuracy. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See 105637
105637	10	35	10	37	This sentence is confusing. How does a trend in potential evaporation exceed a trend in precipitation? [Julian Levy, United States of America]	Not applicable. This sentence has been removed in redrafting to meet the stipulation of a short SPM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
80081	10	36	10	36	Not clear in which way the trends in evaporation exceeded the ones in precipitation. Please elaborate it. [Lilian Fejes, Hungary]	See 105637
50169	10	36	10	36	'There is medium confidence that trends in potential evaporation have exceeded trends in precipitation in some regions and seasons' - it would be helpful to include here which regions and seasons this statement corresponds to. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	See 105637
129913	10	36			Remove the last sentence that begins "There is medium confidence that trends in potential evaporation..." It contributes little. [Trigg Talley, United States of America]	Accepted
42649	10	36			Will be useful to include 'leading to increased dryness' at the end of the sentence. It may not be clear to policymakers that this is the implication. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	See 105637
41811	10	37	10	38	I would state high confidence here. This has happened in some regions. [Sergio Vicente-Serrano, Spain]	See 105637
23365	10	39	10	45	Please check coherence with 10.4.1.2.1 (Andy Turner), 10.4.1.2.2 (Won-Tae Kwon) 10.6.3 (Andy Turner) as well as Ch6 (Prodromos Zanis), and include reference to Ch6 and 10. [Anna Amelia Sörensson, Argentina]	Accepted. This text was revised in HS3.3. We provide reference to Chapter 10
129915	10	39	10	45	This paragraph jumps into the attribution of changes to component forcings. But the reader is not told what the actual observed changes in regional monsoon circulations in South Asia, East Asia, and West Africa have been. Revise accordingly. The last sentence, beginning "There is medium confidence that the recent partial recovery..." is convoluted at best. For example, a revised sentence should state what is the character of the OBS changes -- for instance clarify "recent", and state what "partial recovery means (e.g., what is the baseline). [Trigg Talley, United States of America]	Accepted. This text was revised in HS3.3.
38285	10	39	10	45	The conclusion described in this paragraph that it is "very likely" that aerosols have weakened the East Asian monsoon is supported with insufficient evidence. As known to all, the East Asian monsoon began to weaken around 1980, before which it had been strong, but aerosol emissions only began to increase after 1995-2000, and many studies believe that the weakening of the East Asian monsoon is an effect from natural variability (PDO, Pacific Interdecadal Oscillation)) (Kyung-Ja Ha et al. 2020). Generally speaking, there are large uncertainties in the assessment of the impact of aerosols on the East Asian monsoon. Some research conclusions are inconsistent, and the scientific community still lacks a consensus in this connection. Therefore, it is suggested to delete this paragraph or rewrite it by removing the expression of "very likely", a level of confidence that is not scientifically robust, and by revising the expression "during the second half of the 20th century". Reference: Kyung-Ja Ha et al .2020. Major factors of global and regional monsoon rainfall changes: natural versus anthropogenic forcing. Environ. Res. Lett. 15 034055 [Yaming LIU, China]	Noted. The revised SPM states in HS3.3 that "Global land monsoon precipitation decreased during 1950–1980, partly due to increases in anthropogenic aerosols, but has subsequently increased as a result of greenhouse gas forcing and large-scale multi-decadal variability (medium confidence)."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
53471	10	39	10	45	It is also likely that anthropogenic aerosols have offset the GHG effect on land surface evapotranspiration in many continental areas, thereby postponing the detectability of a net anthropogenic influence on the terrestrial water cycle (such a statement however cannot be made based on the current version of the SOD and may need a stronger coordination between CH6/7/8 about the aerosol dimming effect and its consequences on the water cycle?). [Hervé Douville, France]	Noted. Revised text in HS3.3 states: "Global land monsoon precipitation decreased during 1950–1980, partly due to increases in anthropogenic aerosols, but has subsequently increased as a result of greenhouse gas forcing and large-scale multi-decadal variability (medium confidence). Increases of Northern Hemispheric anthropogenic aerosols weakened the regional monsoon circulations in South Asia, East Asia and West Africa during the second half of the 20th century, offsetting the expected strengthening of monsoon precipitation in response to greenhouse gas-caused warming (high confidence). "
50165	10	39	10	45	If the regional monsoon circulations have weakened, then B2.5 should be clear that the effect of aerosols has been 'more than' offset the strengthening response to GHGs. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The revised SPM states in HS3.3 that "Global land monsoon precipitation decreased during 1950–1980, partly due to increases in anthropogenic aerosols, but has subsequently increased as a result of greenhouse gas forcing and large-scale multi-decadal variability (medium confidence)."
112191	10	41	10	41	It is inferred from models that the monsoon would strengthen under the action of solely LLGHGs. But, real world can be different given the uncertainties about interannual variability. Suggest revising to "an anticipated strengthening of the monsoonal" [venkatachalam ramaswamy, United States of America]	Noted. The revised SPM states in HS3.3 that "Increases of Northern Hemispheric anthropogenic aerosols weakened the regional monsoon circulations in South Asia, East Asia and West Africa during the second half of the 20th century, offsetting the expected strengthening of monsoon precipitation in response to greenhouse gas-caused warming (high confidence). "
130447	10	41	10	41	The number "0.19m" is inconsistent with 18cm in Figure.SPM1. [Panmao Zhai, China]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
26339	10	41	10	41	"offsetting a strengthening" or "offsetting AND strengthening" ? [María Santolaria Otín, France]	Noted. The revised SPM states in HS3.3 that "Increases of Northern Hemispheric anthropogenic aerosols weakened the regional monsoon circulations in South Asia, East Asia and West Africa during the second half of the 20th century, offsetting the expected strengthening of monsoon precipitation in response to greenhouse gas-caused warming (high confidence). "
50171	10	42	10	42	There is medium confidence that the recent partial recovery in intensity of monsoon precipitation over West Africa' - is it possible to quantify how much 'partial recovery' corresponds to? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This sentence has been removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50173	10	42	10	44	This sentence in B2.5 is quite confusing. Do you mean there has also been a partial recovery in surface solar radiation (?) and that this has also contributed to the recovery of monsoon precipitation intensity? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Revised text in HS3.3 states: "Global land monsoon precipitation decreased during 1950–1980, partly due to increases in anthropogenic aerosols, but has subsequently increased as a result of greenhouse gas forcing and large-scale multi-decadal variability (medium confidence). Increases of Northern Hemispheric anthropogenic aerosols weakened the regional monsoon circulations in South Asia, East Asia and West Africa during the second half of the 20th century, offsetting the expected strengthening of monsoon precipitation in response to greenhouse gas-caused warming (high confidence). "
108337	10	42	10	45	Atlas.5.2.2 should be included in the line of cite [Nana Klutse, Ghana]	Noted. This sentence has been removed from the revised SPM.
36105	10	42			I think you can just have "gas-induced" [Michael PRATHER, United States of America]	Noted. The revised SPM states in HS3.3 that "Increases of Northern Hemispheric anthropogenic aerosols weakened the regional monsoon circulations in South Asia, East Asia and West Africa during the second half of the 20th century, offsetting the expected strengthening of monsoon precipitation in response to greenhouse gas-caused warming (high confidence). "
65537	10	43	10	43	Suggest clarification. The text should state: "greenhouse gas increases". [Kushla Munro, Australia]	Noted. This sentence has been removed from the revised SPM.
87455	10	43	10	43	gas' not 'gases' (to match 'increases'). See also line 42. [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This sentence has been removed from the revised SPM.
27821	10	44	10	45	In section A it was written that aerosols globally decreased in the atmosphere. Is the increase in solar radiation reaching the surface linked to a decrease in aerosols in West Africa? Was the weakening related to changes in solar radiation resulting from aerosols or are other processes involved? The way the last sentence is written, it seems that all changes are linked to solar radiation. If this is correct then it deserves to be written clearly. [Eric Brun, France]	Noted. This sentence has been removed from the revised SPM.
44725	10	44	10	45	"an overall effect..." is unclear. Changes in aerosols? Some explanation on what kind of changes would be useful. [Markku Rummukainen, Sweden]	Noted. This sentence has been removed from the revised SPM.
97239	10	44	10	45	Please specify if this recovery is due to a decrease in anthropogenic aerosol concentrations. [Nicole Wilke, Germany]	Noted. This sentence has been removed from the revised SPM.
81887	10	44	10	45	It's not clear what a "partial recovery in surface solar radiation due to an overall radiative effect of anthropogenic aerosols" means. Use plainer language [Dan Zwartz, New Zealand]	Noted. This sentence has been removed from the revised SPM.
36107	10	44			more explicit: due to a decrease in aerosols. "overall radiative effect" is very confusing. [Michael PRATHER, United States of America]	Noted. This sentence has been removed from the revised SPM.
37461	10	46	10	46	Yes, there is no such line; my point is that you omit some critical issues. How has cloud cover changed since 1950 (because it is important in determining the Earth's energy budget) ? How have winds changed since 1950 (because they are vital to the distribution of heat and to evaporation)? [John McLean, Australia]	Noted. This comment mislocated and we cannot identify where it refers to. Please note that the ERF of clouds and their associated feedbacks on the global energy budget is thoroughly assessed in Chapter 7.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
10865	10	48	11	17	The individual "contributions" (grey arrows) to the greenhouse gases and other anthropogenic forcings should be removed from this figure. They are not formally attribution results, have very large uncertainties (Figure 7.11) and don't add up to what they are supposed to be contributing to. As they are constructed by using simple models using ECS estimates constrained by observed temperatures, their inclusion here is just an example of circular reasoning. It is likely that estimates of the different forcing factors in CMIP6 experiments used in the detection analysis would contradict that of the simple models (e.g. aerosol only forcings). [Gareth S Jones, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Forced estimates are another line of evidence from the emulator in Chapters 6 and 7
69343	10	48	11	17	It is thought that adding quantitative information of each factor (such as best estimate and its likely-range of CO2 contribution to warming of GSAT) to Figure SPM.3 could make this figure more informative. Relating to this point, it appears necessary to clarify the assumed ratio of radiative forcing of each driver (W/m2) to their contribution to GSAT warming (degree C) somewhere appropriate in the section B.1 to evaluate past and future contribution of forcing drivers. [Kaoru Magosaki, Japan]	Taken into account, the SPM2 figure in the final SPM now presents bars for each component and error bars are shown. Forcing can give a misleading picture of historical contribution to temperature. In an advance over AR5, emulators, calibrated to ERF and ECS estimates from Chapter 7, have been used to assess temperature change directly. The relation between radiative forcings and temperature for each component are fully described in Chapter 7.
69345	10	48	11	34	It would seem more logical in sequence, if the Figures SPM.3 and SPM.4 were to be reversed in order, as the SPM.3 shows the contributions of different forcing agents. [Kaoru Magosaki, Japan]	Taken into account. Fig SPM.4 served as a basis for the new figure SPM.1a and Fig SPM.3 served as a basis for new fig SPM.1b and new fig SPM.2
28107	10	48			Regarding Figure SPM.3: - This figure is difficult to read. The first graph cannot be read in when printed in black and white. In the second graph, the grey and blue arrows are difficult to distinguish. It would be better to divide the bar into 4 parts, each part dedicated to one of the arrow. - Moreover, the concept of "other human forcings" is not clear. Also, where does "LUC" come from? From the table constructed for IPCC SRCCL? - We can misread the "LUC" arrow with the error bar on the second panel. - The second figure is globally unclear. [Eric Brun, France]	Taken into account, the SPM2 figure in the final SPM has been optimised graphically and individual anthropogenic components are now shown individually.
90757	10	50	10	51	Will the text in italics be introduced in the caption of Fig. SPM.3? [José Romero, Switzerland]	Rejected - the intents of the figures are necessary because they determine what the figures show. Please note that they are integrated in the revised figures.
80083	10	50	11	15	Figure description is enough, we can omit this first sentence in italic (page 10). Page 10, 4th line: the reference period is missing from here, also, the emulator is not discussed and defined until now so it can be omitted, from the right panel description too. 5th line: previously it was 2009-2018 period instead of 2010-2019 but maybe it can be changed to a longer period of time. The figure description is too long and especially LUC is not so clear, please revise it and make it concise. [Lilian Fejes, Hungary]	Rejected - the intents of the figures is necessary, as it determines what the figure shows. Please note however that they are integrated in the revised figures.
97241	11	0			Caption Figure 5: the purpose-statement in italics refers to Figure SPM.4. [Nicole Wilke, Germany]	Taken into account. This has been corrected.
28109	11	1	11	1	Please replace "in" by "resulting from". [Eric Brun, France]	Editorial

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6359	11	1	11	1	It would be better to write "from observations" rather than "in observations". GSAT is a value deduced from observations, not something that is in observations. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
111451	11	1	11	4	If found this hard to absorb. I suggest a change to "CMIP6 model and emulator simulations with human and natural forcings (orange), with well-mixed greenhouse gases only (grey), with aerosols and other human forcings (blue), and with natural forcings only (green). Solid lines show the CMIP6 mean, dashed lines the emulator median, and shading shows the 5-95% range)." [James Renwick, New Zealand]	Taken into account. The figure has been substantially modified and simplified
86567	11	1	11	15	Fig SPM3. You cannot write "left panel shows GSAT in observations" . GSAT is NOT observed. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
129917	11	1	11	15	Eliminate the dashed lines from the left panel of Figure SPM.3. They add unnecessary complexity to the figure. [Trigg Talley, United States of America]	Accepted. Figure has been substantively simplified.
129919	11	1	11	15	This figure caption is the first place that there has been a reference to an "emulator." There has been no discussion about how the term is being used or how it was formulated. If the emulator is going to be a central aspect of the uncertainty assessment, consider adding it to Box SPM.1 or at minimum define the term in the caption. [Trigg Talley, United States of America]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
90897	11	1	11	16	Figure SPM.3 Being an SPM it may result confuse to present all along these figures two very related concepts: Human influence and greenhouse gases. [Alvaro Zopatti, Argentina]	Taken into account. Figures SPM 3 and SPM 4 have been rationalised
54449	11	1	11	16	Figure SPM.3 Being an SPM it may result confusing to present two very related concepts: Human influence and greenhouse gases. [Maria del Pilar Bueno Rubial, Argentina]	Accepted. Figure has been simplified to include just human influences
112605	11	1	11	32	Having two figures next to each other, one expressed in GMST, the other in GSAT, is asking for trouble. All key figures and budgets could be expressed in terms of GMST. Tokarska et al (2019) claimed that the impact of future sea-ice change precludes this, but their figures show the impact is minimal under ambitious mitigation, and irrelevant (a couple of years of warming) under RCP8.5. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39531	11	3	11	5	Please cite and discuss Wunsch, C., Heimbach, P., 2014, Bidecadal thermal changes in the abyssal ocean. J. Phys. Oceanogr. 44, 2013, who estimate the heat content down to abyssal depths and who question this claim since the heat content is found of approximately 4E22 J in 19 years, for a net heating of 0.2 W/m2, smaller than some published values. Figure 10 of Laloyaux et al (2018) doi: 10.1029/2018MS001273, shows that the ocean heat content seems to follow a 60-70 year cycle, possibly related to Atlantic Multidecadal Oscillation. All this make questionable the 90 % stated in this sentence. [François Gervais, France]	Rejected. Papers are cited and discussed in the underlying chapters not the summaries (TS, SPM) of the report.
29399	11	4	11	4	a) further specifications of the 'emulator' used and its functionality needed. b) state that the fluctuations indicate yearly mean values [Joachim Fallmann, Germany]	Not applicable. Mention to emulator removed, as it was too technical for a SPM. B)'annual' specified in the heading for fig SPM.1b
42619	11	6	11	6	Please explain what is included in "net human influence" and "other human forcings". [Sofie Schödl, Sweden]	Taken into account. This is now covered more explicitly in Figure SPM2.
104365	11	9			Perhaps you need to explain what an emulator is. [Finnveden Göran, Sweden]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
11583	11	10	11	11	Should probably read "salty getting saltier" [Gerhard Krinner, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
34513	11	11	11	12	Figure SPM.3 depicts physical effects of land-use change, which is good, but these effects are not actually discussed in the actual text of the SPM, which seems an oversight. [Russell Vose, United States of America]	Taken into account. Role in figure clarified. Land use discussed in Chapter 7
93617	11	20	11	34	Including the temperature changes on the left of panel A for various paleo periods is very informative. Based on the same idea, I would suggest to add future temperature estimates in 2100 (possibly also in 2300) on the right of this panel. And possibly the temperature change at the Pliocene. To lighten the figure, panel B could be deleted or could contain only the plot with decadal averages. [Jean-Louis Dufresne, France]	Rejected. Revised Figure 1 solely includes past temperatures
28111	11	20			Regarding Figure SPM.4: - The composition of the figure makes it difficult to read, in particular extreme past temperatures. Would it be possible to display all of the past temperature time series since X date (e.g. 200 000 years?) using a logarithmic scale for the x-axis instead? - Moreover, the "Last Interglacial" and the "Mid Holocene" records of temperature cannot be in red or gold because these are colors used in the legend. Letters for panel 'A' and 'B' should be little 'a' and 'b', as in legend. - On the panel A, the lines on the right-hand side are blurry. On the panel B, the different lines are very difficult to distinguish. - Finally, the sources should be presented. [Eric Brun, France]	Taken into account. The figure has been simplified and shows just the past 2ka plus the mid-Holocene to better emphasise intended key messages the reader should take away from the figure
42213	11	20			Fig SPM4: Panel B looks good. For Panel A it is difficult to read the composite x- and y-axes. And the reader might miss the LGM temperature with the current layout. [Tina Christensen, Denmark]	Taken into account. The figure has been substantively revised. for clarity and only the mid-Holocene retained.
80087	11	22	11	32	22nd line: the first sentence can be omitted. 23rd line: "change" is missing after the surface temperature as figures show the change. 27th line: "surface" or "air" is missing before the temperature. 29th line: Cannot it be mean surface temperature instead of land and sea surface temperature? 32nd line: Not clear if the reference written here (anomalies relative to) is valid for figure A. too. [Lilian Fejes, Hungary]	Not applicable. Combining panels of Figure SPM3 and SPM4 has led to a complete rewrite of the caption
36109	11	22			Fig 4 is great! Nice layout. [Michael PRATHER, United States of America]	Noted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
18717	11	27	11	27	A sentence on how the SD (standard deviations) were estimated for mid-holocene and LGM would be useful for the readers. [Govindasamy Bala, India]	Taken into account. The trace to the underlying assessment provides this and is given in the revised caption
28115	11	28	11	28	As this document is for policymakers , a footnote should be added : "SD = standard deviation". [Eric Brun, France]	See 18717
6361	11	29	11	29	Panel b of this figure is rather misleading regarding the agreement between datasets, as there are interdependencies between the five global datasets that are shown. More detailed comment is provided for Chapter 2. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised figure shows solely the average of the products
97243	11	29	11	30	Figure SPM.4 (b): It should please be explained what kind of datasets are shown (observations?, observation-based?, modelled?) and how they differ. [Nicole Wilke, Germany]	Taken into account. This presentation has been simplified in the revised Figure SPM.1 which should avoid the need for such detailed discussion in the caption.
42017	11	37	11	37	FIG SPM.5: Please use same time periods for temperature and precipitation, and make precipitation change more visible. [Juhani Damski, Finland]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
90759	11	37	11	37	Figure SPM.5 is difficult to read. [José Romero, Switzerland]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
65543	11	37	11	47	Suggest dividing this into two, or incorporating equivalent time intervals. It currently refers to four different time periods, which is confusing. In particular, observed precipitation changes since 1901 go to 2016 whereas observed temperature changes goes from 1900 to 1980. This is necessary also because the text highlights the importance of change emerging since the 1970s and 1980s. [Kushla Munro, Australia]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
28117	11	37			Regarding Figure SPM.5: - This figure is too small and not readable. The quality is poor. Moreover, when printed in black and white, dark blue and dark red look the same. - The precipitation changes in light yellow are hardly visible on the figure. The time period chosen on bottom map (1980-2016) gives a picture of recent precipitation changes quite different from the Fig. SPM.2 from AR5: the drying of the Mediterranean region and in North China Plains is no longer visible and the trend in some parts of Western Africa seems to have reversed. Those differences should be rechecked, and if true, commented/explained somewhere. - Please change the legend between the time scales 1900-1980 and 1981-2016. Otherwise, we cannot read the first map, as the differences are much more pronounced for the period 1981-2016. [Eric Brun, France]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
71329	11	39	11	39	Change "The purpose of this figure shows how ..." to "This figure shows how ..." [David Wratt, New Zealand]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
27823	11	39	11	39	Please replace "shows" by "is to show". [Eric Brun, France]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97245	11	39	11	40	Does this sentence belong to Figure SPM.4 rather than Figure SPM.5? [Nicole Wilke, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
80091	11	39	11	45	Figure description is enough, we can omit this first sentence in italic. The text is different than the one under the actual figure on page 49. [Lilian Fejes, Hungary]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
129921	11	42	11	45	The Figure SPM.5 caption needs to be corrected to match what is shown in the graphic. [Trigg Talley, United States of America]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
6363	11	42	11	45	It is open to question whether HadCRUT5 is the appropriate dataset to use here. Its trend over the last forty or so years is an outlier when compared with other well-established datasets, if Table 2.4 is correct. See comment 5 above on the entire report, and subsequent comments on Chapter 2. Composite temperature trends based on multiple datasets would be preferable. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
97247	11	42	11	45	Figure SPM.5: The two top panels show different time periods (temperature: 1900-1980, precipitation: 1901-2016) while the two lower panels show consistent time periods for the last four decades. Please check the time periods in the upper right panel. [Nicole Wilke, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
84705	11	42	11	45	Fig SPM.5, the years' interval in the top of the right-top panel is likely wrong [Annalisa Cherchi, Italy]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
29401	11	42	11	46	The resolution of Figure SPM5 could be improved, further the crosses are not visible [Joachim Fallmann, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
36111	11	42			Fig 5 was a big more difficult understand. It is important. Maybe change the top titles to "Obs Temp Trends" since is it not the 1900-1980 change that is shown. [Michael PRATHER, United States of America]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
104369	11	42			What is HadCRUTv5 and GPCCv8? [Finnveden Göran, Sweden]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
111453	11	44	11	44	Change "more" to "most" [James Renwick, New Zealand]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
112195	11	50	11	50	Is something planned as a report on the COVID19 impacts such as reduced emissions and observed effects on the environment? There may be papers available for review now which may have looked into observable and modeled impacts. [venkatachalam ramaswamy, United States of America]	Taken into account. A cross-chapter box (6.1) was added to the report to cover the covid pandemic and the topic is covered in HS14.1.
77011	12	1	11	13	Too much detail is included here. The text should be shortened and messages clearer. [Emer Griffin, Ireland]	Accepted. As a general rule, we have significantly reduced the length the headline statements (text in blue) and we are trying to keep the language as simple as possible, which includes avoiding IPCC uncertainty language.
77013	12	1	11	13	Key message 90% of additional energy is taken up by the oceans (this amounts to x ZJ and has resulted in ocean temperature increase of z and slr) [Emer Griffin, Ireland]	Taken into account. Text clarified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
12661	12	1	12	41	Here It is also helpful to state the comparison with SROCC/AR5 assessment results, to be more connected to previous assessments. [Lijing Cheng, China]	Noted but please see the Technical Summary for key updates from the AR5 WGI and the three Special Reports. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
12659	12	1	12	44	No regional information here? Combing global/regional information helps a lot, avoid some bothering dispersion of one topic. Specially, some of the A2 texts can move here. [Lijing Cheng, China]	Taken into account. Regional information has been strengthened in the next SPM version, although topics are still placed in the spm depending on the framing of each HS, as such some topics will appear in multiple locations.
67815	12	1	12	45	The impact on changes in sea water temperature, seawater acidification, salinity, and extreme events such as heatwave need to be briefly explained, especially in the Summary for Policymaker section, so that decision makers know what the impact is on their region. [Ruandha Agung Sugardiman, Indonesia]	Rejected. Impacts are not within the mandate of WGI, this is covered in the WGII contribution
17457	12	1	13	7	The link is made to AR5 but not with SROCC - what's new since this special report? Or is the information presented here in such a way as to provide policymakers with a different insight? If so, this may be worth highlighting/explaining this. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted but please see the Technical Summary for key updates from the AR5 WGI and the three Special Reports. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
81913	12	1	13	7	Acknowledgement of the changing physical and biogeographic properties of “coastal seas” is a gap in this summary report. The focus on “oceans” should be broadened in places to include “coastal seas” as they each have different issues. This will connect better with the two chapters in the SROCC report (changing oceans, changing coastal ecosystems). Currently the current draft report refers to coasts only in terms of the terrestrial domain e.g. erosion, flooding risks. This addition will connect better with details provided in sections 5.3.4 and 9.2.3.5 of the main report. [Dan Zwart, New Zealand]	Taken into account. Coastal regions are now found in HS.9.4, HS.11.4 and figure SPM.9.
131985	12	1			Looking at the climate drivers considered in the oceans that might have severe impacts, very clearly, temperature and oxygen values are missing. [Hans Poertner and WGII TSU, Germany]	Taken into account. We hope that Figure SPM.8 has ocean relevant, quantified values of relevance for the oceans.
9491	12	3	12	3	The term 'recent millennia' is not helpful for this audience. What time period is specifically being referred to? Otherwise says over the last X thousand years. [Joelle Joelle Gergis, Australia]	Taken into account. Headline statement significantly rephrased (HS2).
81745	12	3	12	3	About 90% is more correct [Karina von Schuckmann, France]	accepted
37479	12	3	12	3	The sentence cannot be substantiated because you simply do not know. [John McLean, Australia]	Rejected. This statement is firmly grounded in the assessment undertaken in chapter 2
54635	12	3	12	3	"The observed changes in the ocean are unprecedented over recent millennia." This phrase is very vague. Recommend that the authors consider whether some quaifier is needed for this statement (e.g. 'many of the observed changes'). The subsections below note the unprecedented nature of heat uptake, SLR, and ocean acidifcation. [Nancy Hamzawi, Canada]	Accepted. The revised SPM is more specific (HS2.4)
27825	12	3	12	3	Please correct: "About 90%" is more correct than "More than 90%". [Eric Brun, France]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25809	12	3	12	5	It would be more accurate if glacier and ice sheet melting are added to the causes of sea level rise, in addition to water thermal expansion. [Don Alfonso Pino Maeso, Spain]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
25813	12	3	12	7	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
97251	12	3	12	7	The statement that now there is more confidence in ocean warming because sea level budget closes seems strange. The other contributors to sea level rise are much more uncertain than the thermosteric effect, and also in AR5 the sea level budget was closed. It is rather the other way round: by having for the time period till 2006 a global coverage of the upper 2000m of the ocean through Argo and thus improved knowledge about the thermosteric effect, we have now more confidence in the other contributors of SLR like mass loss of ice sheets and glaciers. [Nicole Wilke, Germany]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
90177	12	3	12	13	We think that the main message from section B.3. is missing in the headline summary namely "Global mean sea level (GMSL) has risen by 0.19 m (likely 0.15–0.22 m) between 1900 and 2018, mostly from ocean thermal expansion and glacier melt." In order to make the message more accessible and short we would propose to re-write as follows, "The observed changes in the ocean are unprecedented over recent millennia. Global mean sea level (GMSL) has risen by 0.19 m (likely 0.15–0.22 m) between 1900 and 2018, mostly from ocean thermal expansion and glacier melt. There is high confidence that present surface ocean pH observations are at their lowest values for the past two million years and it is virtually certain that ocean acidification is predominantly driven by the ocean uptake of anthropogenic carbon dioxide. It is virtually certain that large-scale changes in near-surface and subsurface salinity patterns (fresh get fresher, saltier get saltier) have occurred since at least 1950, adding to the observational evidence for an intensification of the water cycle." [Georges Gehl, Luxembourg]	Taken into account but not applicable. Headline statements have been significantly revised and the narrative has been significantly altered. As result there is no headline statement that specifically focuses on the changes of the ocean.
37481	12	3	12	13	These references are hopeless because they lead to huge numbers of pages (e.g. 2.3 is from page 65 to 80 of that chapter, 5.3 and 5.4 are from page 43 to 76 of that chapter). [John McLean, Australia]	Rejected. The citation follows stipulated guidance.
129923	12	3	12	13	Section B.3 addresses ocean changes related to GHG emissions and climate change. Given the grave implications of ocean acidification (threatening to dissolve coral reefs, mollusk shells, and other calcium carbonate based marine biota) and deoxygenation (a threat to all aerobic marine biota, which depend on oxygen) as well as sea-level rise (destruction of low lying coastal cities worldwide), the critical importance of these ocean parameters might be emphasized by adding language to the first sentence of the pink box summary, as follows: "The observed changes in the ocean are unprecedented over recent millennia, AND POSE MAJOR RISKS TO MARINE ECOLOGY AND HUMAN CIVILIZATION." [Trigg Talley, United States of America]	Rejected. Risk and impacts are within the mandate of WGII
5287	12	3	12	13	A well-written red box except for an excessive number of confidence statements that distract from the message. [Daniel Murphy, United States of America]	Rejected. Confidence statements are requested by policymakers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78267	12	3	12	13	It would be good to elevate the global mean sea level (GMSL) rise of 0.19m between 1900 and 2018 (B.3.2) into the box summary. This is headline finding relevant to policymakers. [Leonie Lee, Singapore]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
107981	12	3	12	13	Given the important implications of ocean de-oxygenation, it could be highlighted in the headline box. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
108247	12	3	12	13	The first sentence should be the last. The reader first needs to know the changes before she/he should be informed that they are unusual. [Johannes Quaas, Germany]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
97249	12	3	12	13	Please explain if this is a result from AR5 with or without own AR6 assessment. [Nicole Wilke, Germany]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
50175	12	3	12	13	The emphasis on thermal expansion in B3 and B3.2 mean that it is not clear that ice sheet and glacier contributions (over recent period 2006-2015) are the dominant cause of GMSL rise, rather than thermal expansion, as stated in SROCC. This could be clarified in B3.2 by changing this to: 'Global mean sea level (GMSL) has risen by 0.19 m (likely 0.15–0.22 m) between 1900 and 2018; the dominant cause of change in GMSL over this period is glacier melt, followed by thermal expansion.' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
34973	12	3	12	25	The SOD claims that recent ocean heating is unprecedented over recent millennia. Please see rebuttal comment #5 above. [Jim O'Brien, Ireland]	Rejected. The unprecedented nature of ocean heating is clearly traceable to the underlying chapter assessments. For example, Chapters 2, 5, 9.
81747	12	4	12	4	is stored in the ocean': this wording would better reflect the physical process behind. [Karina von Schuckmann, France]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
27827	12	4	12	4	Please replace "is absorbed by the ocean" by "is stored in the ocean": this wording would better reflect the physical process behind. [Eric Brun, France]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6367	12	4	12	4	"as a result of greenhouse gas emissions" is incorrect. The energy absorbed by the ocean is more than 90% of the net energy added to the climate system by human activities, which includes emission of greenhouse gases but also includes emissions of aerosols and pre-cursor species. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified
108551	12	4	12	5	This seems inconsistent with SPM-13 lines 18-19 [Jason Donev, Canada]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
36113	12	4			emissions' => 'increases' [Michael PRATHER, United States of America]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore. Moreover, the revised headline statement are very different and not as detailed as before.
26175	12	5	12	5	"primarily" should be added before "through". [Toshihiko Takemura, Japan]	Taken into account. Text clarified
81749	12	5	12	5	both, ocean warming and sea level rise need to be mentioned here. Ocean warming had been identified in SROCC as one of the major threats of climate change with wide-reaching consequences/impacts (WG1 & WG2) In general, ocean warming which is assessed in chapter 2 is missing here, and should be added, including confidence level. Particularity: the first under-point (B3.1) is addressing OHC - though it should be also added in the major summary for the ocean change [Karina von Schuckmann, France]	Taken into account. Text clarified and both are added
42403	12	5	12	5	consider "contributing" instead of "leading" [Tina Christensen, Denmark]	Accepted. Text simplified
27829	12	5	12	5	Both ocean warming and sea level rise need to be mentioned here. Ocean warming had been identified in SROCC as one of the major threats of climate change with wide-reaching consequences/impacts (WG1 & WG2). In general, ocean warming which is assessed in chapter 2 is missing here, and should be added, including confidence level. The first under-point (B3.1) is addressing OHC - though it should be also added in the major summary for the ocean change. [Eric Brun, France]	Accepted. Ocean warming added
110799	12	5	12	5	thermal extension + ice melt [cathy clerbaux, France]	Accepted. Text clarified
38901	12	5	12	5	Can "leading to" please be replaced by "contributing to" to indicate that there are also other factors that cause sea level rise? [Maike Nicolai, Germany]	Not applicable. Text significantly revised
81751	12	5	12	6	There are already various comments in the corresponding chapter 7 on the use of specific wording. Here, again another is introduced, and other as 'Earth system warming' etc have been used. Coherency for clarity is needed. Moreover, the use of 'planetary heat gain' might be not adequate for a wider audience. [Karina von Schuckmann, France]	Accepted. Wording simplified
27831	12	5	12	6	Regarding the term "planetary energy gain": there are already various comments in the corresponding chapter 7 on the use of specific wording. Here, again another is introduced, and other, as "Earth system warming", have been used. Coherency for clarity is needed. Moreover, the use of "planetary energy gain" might be not adequate for a wider audience. [Eric Brun, France]	Accepted. Text simplified
38903	12	5	12	6	The expressions "planetary energy gain" and "consistent closure of the global sea level budget" might not be understood by the target audience of the SPM. Can this be described in more common words? [Maike Nicolai, Germany]	Accepted. Language simplified.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50177	12	5	12	7	"Confidence in the assessment of the planetary energy gain is higher than in AR5 through consistent closure of the global sea level budget for the period 1971–2018" - It is not clear why this is a headline statement observed ocean changes, nor is it expanded upon in any of the subsections of B3, I suggest this could be removed, or moved to it's own subsection to reduce the length of the B3 headline statement. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified
42019	12	5	12	7	Please, remove sentence "Confidence in the assessment..." from the headline statement. [Juhani Damski, Finland]	Taken into account. Text clarified
23367	12	5	12	7	Is confidence higher because the period is larger than in AR5 or because in AR5 the global energy budget could not be closed consistently? [Anna Amelia Sörensson, Argentina]	Taken into account. Text clarified
131703	12	5	12	7	This is a long headline - could the statement re closure of global sea level budget be moved to a bullet - this aspect is not currently picked up in the bullets [Hans Poertner and WGII TSU, Germany]	Accepted. Text simplified
86943	12	5	12	7	We find most of the information provided in this highlighted conclusion to be policy relevant, however we feel that it is a little too long in its current form. Please consider if the third sentence starting with "Confidence in the assessment" is really needed as a highlighted conclusion. We think this finding could be picked up in one of the associated bullets,, or that a new B.3.1 para could be drafted with the view to inform readers about progress since AR5. [Oyvind Christophersen, Norway]	Accepted. Text simplified
25811	12	5	12	7	It would be useful to explain the concept of "consistent closure of the global sea level budget" since it seems it does not appear in the ensuing paragraphs. [Don Alfonso Pino Maeso, Spain]	Accepted. Text clarified. HS4.3 covers this aspect but does not mention the term 'closure of sea level budget'
81753	12	6	12	6	what is stated in the correspondign chapter (7 & 9) is that the link of the sea level bduget and the energy budget is primalriy given through the ocean heat component. But this does not imply that the consistent closure of the heat budget explains the increase in heat gain since AR5 - mis-leading wording, needs to be changed. Both budget closure approaches are used for cross-confirmation of results. [Karina von Schuckmann, France]	Accepted. Language simplified.
81813	12	6	12	6	about 90% - and as this occurs already the third time in the SPM, maub question whether it should be removed soemwhere to avoid repetition [Karina von Schuckmann, France]	Accepted. 90% numbers only features now in the revised SPM
27833	12	6	12	6	What is stated in the corresponding chapters (7 & 9) is that the link of the sea level bduget and the energy budget is primarily given through the ocean heat component. But this does not imply that the consistent closure of the heat budget explains the increase in heat gain after AR5 - mis-leading wording, needs to be changed. Both budget closure approaches are used for cross-confirmation of results. [Eric Brun, France]	Accepted. Language simplified.
78269	12	6	12	6	Suggest to explain what is meant by "global sea level budget" [Leonie Lee, Singapore]	not applicable. Term removed.
104381	12	6	12	6	Policy makers will not understand the phrase "consistent closure of the global sea level budget." Please use plain English [Hunter Cutting, United States of America]	Accepted. Language simplified.
87329	12	7	12	7	insert a sentence on sea level change [Marcel Berk, Netherlands]	Accepted. Text clarified
108245	12	7	12	7	Drop the "observations" since it is the pH itself that is at the lowest values. [Johannes Quaas, Germany]	Accepted. 'Observation' has been removed and the text slightly changed with the angle of attribution rather than past change assessment

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
38905	12	7	12	8	I suspect not the observations are at their lowest value, but the values themselves? I would also suggest to explain more clearly that lower pH means the ocean is becoming more acidic. [Maike Nicolai, Germany]	Noted. 'Observation' has been removed and the text slightly changed with the angle of attribution rather than past change assessment. The definition of ocean acidification is clearly in the glossary.
77595	12	8	12	8	Explain 'fresh get fresher' [Emer Griffin, Ireland]	not applicable. Term removed.
34515	12	8	12	8	I realize the term "ocean acidification" is used with some regularity, but it is technically inaccurate. The average pH of the ocean is about 8.1, whereas a pH less than 7 is acidic, so ocean water is slightly basic. A more precise choice of words would be, "The ocean has increased in relative acidity." [Russell Vose, United States of America]	Rejected. Although we agree on the technical aspect, ocean acidification is the commonly used term to define increase in relative acidity, and is clearly defined without ambiguity in the report glossary
31561	12	9	12	9	"virtually certain" is inconsistent with Chap2 for subsurface salinity. Chap 2 assesses very likely for subsurface salinity. This is a subject of concern and disagreement between authors of different chapters (which is unfortunately reflected here in SPM) that needs to be addressed by a discussion between Chap 2, 3 and 9 (arguably that should be done and solved during pre-Lam activities). [Jean-Baptiste SALLEE, France]	Not applicable the assessment of past salinity change has been removed, to shorten SPM. We only retained attribution and ensured consistency with underlying chapters
97253	12	9	12	10	Please state the progress in the confidence level compared to AR5 (and SROCC), or is this also a SROCC result? [Nicole Wilke, Germany]	Not applicable the assessment of past salinity change has been removed.
23369	12	9	12	12	This line of evidence is drawn from observations of the ocean but would perhaps fit better together where the water cycle intensification is discussed? Would it be B.5 Extremes? Just a suggestion. [Anna Amelia Sörensson, Argentina]	Noted. The narrative and structure of the SPM have been completely revised. Salinity is now discussed with precipitation change in HS1.4.
81503	12	9	12	12	Recommend to replace 'intensification' to another word that could reflect the 'level of intensification of water cycle' clearer. [Ee Ling Lee, Malaysia]	Not applicable the assessment of water cycle change has been removed
38907	12	9	12	12	Your illustration of the salinity patterns is so tangible that I would free it from the brackets, for example by rephrasing: "It is virtually certain that large-scale changes in near-surface and subsurface salinity patterns that make fresh areas of the ocean fresher and salty ones saltier have occurred since at least 1950, adding to the observational evidence for an intensification of the water cycle." [Maike Nicolai, Germany]	Not applicable the assessment of past salinity change has been removed, to shorten SPM.
129925	12	10	12	11	Should read "...salty get saltier" [Trigg Talley, United States of America]	Not applicable. Sentence removed.
69347	12	10	12	11	"saltier get saltier" should be "salty get saltier" [Kaoru Magosaki, Japan]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
27835	12	11	12	12	The phenomena of "intensification of the water cycle" should be added to glossary. [Eric Brun, France]	Rejected. Chapter 8 explains the multiple changes that are occurring to the water cycle leading to its intensification.
25815	12	11	12	12	It would be useful to explain the concept of "intensification of the water cycle" since it also appears in the ensuing paragraphs. [Don Alfonso Pino Maeso, Spain]	Noted. In the revised SPM the concept of intensification of the water cycle is better specified with examples/details and is based on multiple lines of evidence integrating information from all aspects of the water cycle
9493	12	12	12	13	The intensification of the water cycle is mentioned here but no cross reference to chapter 8 on water cycle changes. Suggest referring to section 8.2 and 8.3 [Joelle Joelle Gergis, Australia]	Taken into account. Specific reference to water cycle intensification and specific sections of chapter 8 have been included in the final SPM

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101557	12	12	12	13	Change "mass, snow cover extent and sea-ice area, as well as increases of permafrost temperature have been observed." to "mass, snow cover extent, and sea-ice area, as well as increases of permafrost temperature, have been observed." [Knut Nadelhoffer, United States of America]	Editorial. Text rewritten.
27837	12	16	12	16	Please correct: "about 90%" is more correct than "more than 90%". [Eric Brun, France]	Taken into account. Text clarified and simplified
37483	12	16	12	17	Your claim that the increase in OHC is due to greenhouse gases is unsupportable. Changes in cloud cover will change the insolation reaching the ocean and will therefore impact OHC. [John McLean, Australia]	Rejected. The closure is covered in Chapter 7, Section 7.2
104095	12	16	12	17	Clarify whether the statement of 90 % of energy absorbed is only from GHGs, or would it pertain to the forcing of all climate forcers (including cooling from aerosol)? In the high-level summary this is presented as a statement of fact, but here 'only' extremely likely. It would be good to clarify what is determining the residual uncertainty: is the uncertainty referring to the magnitude of the 90 %, or to the influence of anthropogenic activities ? [Philippe Tulkens, Belgium]	Taken into account. Text clarified and simplified
25817	12	16	12	17	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
108249	12	16	12	17	It would be good to provide the number of the OHC change. [Johannes Quaas, Germany]	Taken into account. Text clarified and simplified
50179	12	16	12	25	The second sentence in B3.1 ("It is extremely likely that anthropogenic forcing has made a substantial contribution to the OHC increase over the historical period") seems unnecessary as the first sentence in B3.1 already attributes OHC increase to GHGs, which we know are anthropogenic in nature. I suggest that the word 'anthropogenic' could be added before 'greenhouse gases' to emphasise this point, and then the second sentence could be deleted, or if it is trying to make a separate point, then further explained. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
31567	12	16	12	25	Time frame (1971-2018) needs to be clarified in this paragraph. [Jean-Baptiste SALLEE, France]	Taken into account. Text clarified and simplified
12649	12	16	12	25	Time period should be provided [Lijing Cheng, China]	Taken into account. Text clarified and simplified
97255	12	16	12	25	The OHC increase needs to be quantified in energy units (Zeta Joules) and possibly in every day world units as to convey its significance. [Nicole Wilke, Germany]	Taken into account. Text clarified and simplified
107785	12	16			When reading "The observed increase in ocean heat content (OHC) represents more than 90% of the observed total Earth system warming from greenhouse gases" I would appreciate having immediately (via a footnote for instance) the information of the 10% remaining [FREDERIC MENARD, France]	Taken into account. Text clarified and simplified
108547	12	17	12	17	I think the ocean is getting more heat, I don't think it's actually warming more. The first is a statement of where the energy is going, the second is a statement about the temperature. The ocean's temperature is changing less because it has a higher heat capacity. [Jason Donev, Canada]	Taken into account. Text clarified and simplified
111455	12	17	12	17	Should this be "greenhouse gas increase"? [James Renwick, New Zealand]	Taken into account. Text clarified and simplified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8107	12	17	12	17	Clarify whether the statement of 90 % of energy absorbed is only from GHGs, or would it pertain to the forcing of all climate forcers (including cooling from aerosol)? In the high-level summary this is presented as a statement of fact, but here 'only' extremely likely. It would be good to clarify what is determining the residual uncertainty: is the uncertainty referring to the magnitude of the 90 %, or to the influence of anthropogenic activities ? [Frank Dentener, Italy]	Taken into account. Text clarified and simplified
6369	12	17	12	17	"from greenhouse gases" is wrong. See preceding comment. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
132611	12	17	12	18	Can we not provide a stronger statement than "it is extremely likely that anthropogenic forcing has made a substantial contribution to the OHC over the historical period"? It is unclear how large "substantial" is, more than half? Note that Chapter 9 states that "it is virtually certain that anthropogenic forcing caused the increase in OHC in the upper and intermediate ocean layers", which is where the bulk of the OHC change occurred in observations. [Kyle Armour, United States of America]	Taken into account. Text clarified and simplified
23371	12	17	12	18	"It is extremely likely that anthropogenic forcing has made a substantial contribution to the OHC increase over the historical period." Substantial contribution" is vague, so it is a bit strange to combine with "extremely likely". [Anna Amelia Sörensson, Argentina]	Taken into account. Text clarified and simplified
54633	12	17	12	18	This is an example of a broader issue that arises in multiple places and must be addressed. The text states that it is 'extremely likely' (i.e. >99% probability) that anthropogenic forcing has "made a substantial contribution". The word 'substantial' is not a calibrated term and will be understood differently by different readers, thereby severely undermining the value of the likelihood statement at the beginning of the sentence. If 'substantial' is read as 'significant' versus 'more than half' versus 'almost all', the associated likelihood value would necessarily be different. Likelihood values, which are rather precisely calibrated, should only be used in the case of specific and clearly articulated quantities/outcomes/events. [Nancy Hamzawi, Canada]	Taken into account. Text clarified and simplified
129927	12	17	12	18	Reorder the sentence that currently begins "It is extremely likely...." to "The OHC has increased over the historical period, and it is extremely likely that anthropogenic forcing has made a substantial contribution." [Trigg Talley, United States of America]	Taken into account. Text clarified and simplified
109307	12	17	12	18	Unless there is a glossary definition, the word "substantial" seems too vague to be useful in an "extremely likely" statement. This sentence could be interpreted to mean that we have very high certainty that 20 percent or more of OHC increase is due to anthropogenic forcing." [Paul Edwards, United States of America]	Taken into account. Text clarified and simplified
44727	12	18	12	18	"substantial" is vague. Would it be possible to be more explicit? [Markku Rummukainen, Sweden]	Taken into account. Text clarified and simplified
61347	12	18	12	21	I confirm the high confidence in the warming but the vertical distribution is inconsistent with respect to Sect. 9.2.2.1 and Sect. 2.3.3.1. (especially Table 2.7). in Sect. 9.2.2.1, you forward a 60%, 30% and 10% split for layers 0-700m, 700-2000m and >2000m respectively. Table 2.7 suggests however: 70%, 25% and 5% . Please try to be consistent and, if necessary adjust. [APECS, MRI, PAGES ECN, PYRN and YESS ECS group review, Canada]	Taken into account. Text clarified and simplified
37509	12	18	16	21	Your claim is unsustainable because the coverage of such data is poor, not only spatially but also temporally. [John McLean, Australia]	Taken into account. Text clarified and simplified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50197	12	19	12	19	In the SPM, 'warming extends through the entire water column' is assigned high confidence, but in the ES of Chapter 9 (pg 5 line 12) this statement is assigned very high confidence. Please could you ensure the confidence level is consistent across the report. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Confidence level was checked.
65549	12	21	12	21	Suggest clarification as this is not true everywhere, e.g. oceanic zones of deep convection. [Kushla Munro, Australia]	Taken into account. Text clarified and simplified
111457	12	21	12	21	Remove "The" at the start of the sentence. [James Renwick, New Zealand]	Taken into account. Text clarified and simplified
108251	12	21	12	21	It should be clarified what "slowly" is [Johannes Quaas, Germany]	Taken into account. Text clarified and simplified
36115	12	22			The commitment is first to OHC uptake, and then to SLR. reverse the order here. [Michael PRATHER, United States of America]	Taken into account. Text clarified and simplified
27839	12	23	12	23	Regarding "decades to centuries": can you say even "millenia"? [Eric Brun, France]	Taken into account. Text clarified and simplified
44729	12	23	12	24	The ""tend to be dominated" is vague and unclear. The sentence could also be omitted for brevity. [Markku Rummukainen, Sweden]	Taken into account. Text clarified and simplified
25821	12	23	12	24	Please consider adding the rest of the sentence contained in chapter 9, page 5, lines 16-17: " that does not affect global heat content while at longer time scales the pattern is dominated by additional heat gained at the surface changing water-masses" [Don Alfonso Pino Maeso, Spain]	Taken into account. Text clarified and simplified
38909	12	23	12	24	I am afraid I do not fully understand what this last sentence of B3.1 means in this context and suspect other non-specialists might have a similar problem. I gather that changes in OHC vary regionally, but what is the role of internal variability of circulations and is it natural? Do you expect the natural variability of circulations to play a larger role than human-induced warming? [Maïke Nicolai, Germany]	Taken into account. Text clarified and simplified
78931	12	23	12	25	heat carbon nexus [Pedro Monteiro, South Africa]	Taken into account. Text clarified and simplified
12651	12	23	12	25	The current statement is not correct. Should be "by internal variability in both ocean circulation and air-sea heat exchanges" [Lijing Cheng, China]	Taken into account. Text clarified and simplified
65545	12	27	12	27	Suggest improving consistency. The text states that "sea level has risen 0.19 m" which is a different number and unit compared to Figure SPM1 (18 cm). [Kushla Munro, Australia]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
80397	12	27	12	27	Global mean sea level is first introduced in SMP-7, line 3. Thus, GMSL should be defined there. [Paola Arias, Colombia]	Accepted. GMSL is now spelt out
41239	12	27	12	27	I suggest you use same SLR units (m or mm) in B3 and B4. Also a mismatch in the time periods in the two sections [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. B4 has been changed to discuss percentage contributions to sea level, rather than sea level change. Which ensure there is no inconsistency in unit used
38287	12	27	12	27	It is pointed out in this sentence that the global average sea level has risen by 0.19m over 1900-2018, a data that is 18cm in Figure SPM.1 (line 39, page 5) but 0.19m again in line 19 on page 7 in Chapter 9. It is suggested to make verification and unified revision. [Yaming LIU, China]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
130449	12	27	12	27	"Surface-intensified temperature and salinity changes have increased the stratification of the upper ocean at a rate of 5-20% per decade for the period 1970 to 2018 (medium confidence)" which is inconsistent with SROCC (<=1% per decade). [Panmao Zhai, China]	Not applicable. The text has been removed from the SPM
86945	12	27	12	27	In Figure SPM1 it is stated that GMSL is 18 cm, while here it is 19 cm. Please correct. [Oyvind Christophersen, Norway]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69349	12	27	12	27	In B.3.2 Global mean sea level has risen by 0.19m. However, in Figure SPM.1 Sea level rising +18cm [Kaoru Magosaki, Japan]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
69351	12	27	12	27	In B.3.2 Global mean sea level has risen by 0.19m. However, in Figure SPM.2 Sea Level: +18cm [Kaoru Magosaki, Japan]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
23373	12	27	12	28	A related statement is found in the B.4, but in the headline statement: "Glacier and ice sheet loss has likely been the largest contributor to global sea level rise since 1993." It would be better to collect all on GMSL rise in one place so that the relative roles of the two factors (thermal expansion and glacier melt) are clear - and if the roles have changed with time (my interpretation is that glacier and ice sheet melt have gained importance after 1993, but it is not really clear). [Anna Amelia Sörensson, Argentina]	Rejected. We kept two separate statement, one on overall sea-level assessment, and one on underlying processes causing SLR. To reduce confusion, the contributions to SLR are now discussed in percentage change
78959	12	27	12	28	0,19m: this is the same estimate than in AR5 SPM (B4 headline), but until 2018 rather than 2010. To avoid giving the false impression that the increase remains moderate and/or that there was no increase over the last decade, we think that it is important to state that over the 2 or 3 last decades the rate of increase in GMSL was 2 or 3 times larger than over the whole 1900-2018 period. [Martine Vanderstraeten, Belgium]	Accepted. The rate of increase and their change over different periods are now described
42611	12	27	12	28	Perhaps add that during recent years, melting of land ice in the polar regions has become a major source of SLR. [Sofie Schöld, Sweden]	Accepted. We now discuss different periods in terms of rate of change. Contribution of polar regions and other processes are presented in another bullet
37511	12	27	12	28	According to my analysis of the PSML dataset, the average number of reporting gauges in 1900 was 81.2 of which 79.4 were in the northern hemisphere and just 1.8 were in the Southern Hemisphere. Of those in the NH, 45 of the 82 gauges (more than 50%) were in the Baltic Sea, which is known to be shifting isostatically. Even in 1950, of the average of 285.2 gauges that reported 252 were in the Northern Hemisphere and 33.2 in the SH. On top of that ... (a) many gauges are in rivers or at rivermouths and impacted by river flow and (b) there are many instances of tvery different trends in SL height from stations less than 5km apart. You really should audit the key data that you cite because then you will discover how uncertain they are. [John McLean, Australia]	Noted. We encourage the reviewer to read chapter 9 where all details of the assessment can be found. We confirm that the reported assessment is consistent with chapter 9
10185	12	27	12	28	Consistent with ch 9, but note figures say 18 cm [Robert Kopp, United States of America]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
25823	12	27	12	28	Please consider adding Greenland ice sheet melting as a cause of sea level rise, in addition to thermal expansion and glacier melting. [Don Alfonso Pino Maeso, Spain]	Accepted. This is treated in HS4
97257	12	27	12	28	It should please be stated if this confirms an SROCC result or differs from SROCC. [Nicole Wilke, Germany]	Rejected. Consistency with SROCC is discussed in the technical summary and underlying chapters
97259	12	27	12	28	The statement should be expanded by reporting the changing rate of SLR. [Nicole Wilke, Germany]	Accepted, now included

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74013	12	27	12	31	While the values range might be right, the interest is also for the period 1992 through 2018, period where both satellite and tide gauges data became available with higher reliability. High resolution sea level data gathered by myself at GLOSS #80 sea level station provided a sea level rise off the Mediterranean coast of Israel of 13 cm for the period 04.1992-03.2014 (22 hydrological years). [Sergiu Dov ROSEN, Israel]	Rejected. We chose here to provide the long term context. Different time periods can be found in underlying chapter 2 and 9. We however now added rate of changes for different periods, including last decades
88893	12	27	12	31	I see the reference to 'accelerating' change quite often in conjunction with GMSL and ocean heat content. This is perfectly in line with increasing heat uptake associated with a near-linear increase in surface temperature because the deep ocean lag behind and the temperature difference increases. The communication issue is that an accelerating GMSL rise does not imply that other types of climate change, such as GMST, is also accelerating. [Thorsten Mauritsen, Sweden]	Noted. We agree that there is a communication challenge
12657	12	27	12	31	Sea level budget can be included. [Lijing Cheng, China]	Rejected. Processes leading to sea level are discussed in another bullet
37513	12	27	12	31	The term GMSL is only applicable to the (questionable and unverified) satellite-based measurements because it is drawing a long bow to claim that scattered tide gauges, unevenly distributed around the world, can provide a global average. And on this subject, like with CO2 measurements you are attempting to concatenate measurements taken by very different methods and in very different locations, which I'm sure your authors know is unacceptable scientific practice. [John McLean, Australia]	Noted. We encourage the reviewer to read chapter 9 where all details of the assessment can be found, including a discussion of the different source of observations and their limitations. We confirm that the reported assessment is consistent with chapter 9
129929	12	27	12	31	[CONFIDENCE] Add high confidence to statement on GMSL and clarify that anthropogenic activities are responsible for more than half of observed GMSL. See Chapter 9, page 7: " It is very likely that anthropogenic activities are responsible for more than half the observed GMSL change since the 1970s (high confidence)." Suggest adding Section 9.6.1 as a reference, as done in the Chapter 9 Executive Summary. [Trigg Talley, United States of America]	Accepted. confidence statement and attribution have been added
34975	12	27	12	31	The SOD claims that GMSL has risen faster in the last century than in the last 3 millennia. Please see rebuttal comment #6 above. [Jim O'Brien, Ireland]	Noted. All rebuttal comment are carefully considered and responded to
104097	12	27	12	31	The figure of 0,19 m should be better commented, including a comparison with AR5 figure, and complemented with more meaningful numbers, such as the corresponding area of submerged land, or the increase of decadal wave height. [Philippe Tulkens, Belgium]	Rejected. We here only provide an overall assessment of global mean sea-level. More details on sea-level change can be found in underlying chapter 2 and 9
104383	12	27	12	31	It appears that the SPM fails to report the increase of coastal flooding such as high-tide flooding that has increased in low-lying areas to due sea level rise. Such nuisance flooding is now affecting land values and economic production and should be flagged for policy makers. This statement could go here. [Hunter Cutting, United States of America]	Rejected. The change in extreme sea-level events are discussed in other places of the SPM in the context of future change. Specifically under HS9 and HS11
42215	12	27	12	31	B3.2: Consider for consistent treatment of sea level in the same unit, i.e. either m or mm. Cryospheric contributions are quoted in mm in B4, sea level in B3 in m. [Tina Christensen, Denmark]	Accepted. To reduce confusion, processes contributing to SLR are provided in percentage contribution
129931	12	27			Previous text and figures have given 0.18 m (18 cm) (e.g., Figure SPM.1, line 39). [Trigg Talley, United States of America]	Taken into account. Sea level numbers are now consistent but note that observed sea level rise is no longer shown in a figure.
27841	12	28	12	28	The actual current contribution of thermal expansion and ice sheet and glacier mass loss could be given here. [Eric Brun, France]	Rejected. Processes leading to sea level are discussed in another bullet (HS4)
108253	12	28	12	28	Why not provide the percentage contributions of thermal expansion and glacier melt? [Johannes Quaas, Germany]	Rejected. Processes leading to sea level (in percentage change) are discussed in another bullet

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
38911	12	28	12	28	Instead of or in addition to "glacier" I often find the words "ice sheets" in this report (e.g. SPM B4). So I wonder what your readers would think of when "glacier melt" is used here. Would it make sense to harmonise the language? Or list all types of ice masses here if that is correct as well? [Maike Nicolai, Germany]	Noted. glacier and ice sheet are defined in the glossary
108255	12	28	12	29	Also for the rate of sea-level rise, a number would be good. [Johannes Quaas, Germany]	Accepted. Rates now included
17583	12	28	12	31	Not a balanced summary of all the evidence. Tide gauge measurements do not show any acceleration. It is only by combining satellite data with tide gauges that some authors make this claim. The time period for these 6 different satellite measurements is too small to make such an assertion. The satellite data are calculated based on 6 different satellite raw data sets and are only obtained after many fundamental and structural (sometimes ad-hoc) corrections to the original raw data. The error range of this "correction procedure" together with the short satellite time period does not justify this summary. [ferdinand meeus, Belgium]	Rejected. We encourage the reviewer to read chapter 9 where all details of the assessment can be found, including a discussion of the different source of observations and their limitations. We confirm that the reported assessment is consistent with chapter 9
50185	12	29	12	29	GMSL change has accelerated since the late 60s' - please can you quantify the rate of change over this period? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Rate of change and its increase are now included.
104099	12	29	12	29	Please also give the GMSL rise (range) since 1970, to strengthen this key-finding. [Philippe Tulkens, Belgium]	Rejected. However the rate of change over different periods are now included.
8109	12	29	12	29	Please also give the GMSL rise (range) since 1970, to strengthen this key-finding. [Frank Dentener, Italy]	Rejected. However the rate of change over different periods are now included.
69353	12	29	12	30	It would be useful for readers to add reasons why GMSL change has accelerated since the late 1960s. [Kaoru Magosaki, Japan]	Noted. The percentage contribution of SLR are now provided in HS4
42359	12	29	12	31	SPM Figure 6: Rather complicated. A lot of information related to each symbol which makes it difficult to read. The abbreviations for the regions (?) are not given. [Tina Christensen, Denmark]	Taken into account. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
42405	12	30	12	30	is anthropogenic forcings the same as climate impact driver? [Tina Christensen, Denmark]	Noted. No it is not; climate impact driver is defined in the glossary, in FAQ12.1 and in footnote 36 of the final (approved) SPM.
37515	12	30	12	31	Neither of the references that you cite say anything about anthropogenic forcings causing any sea level rise so this sentence is unsustainable. [John McLean, Australia]	Rejected. We encourage the reviewer to read chapter 3 and 9 where all details of the assessment can be found, including limitations of the assessment. We confirm that the reported assessment is consistent with chapters 3 and 9
25825	12	30	12	31	Please consider replacing "main driver" for "are responsible for more than half" in accordance with chapter 9, page 7, lines 21-22. [Don Alfonso Pino Maeso, Spain]	Rejected. Main driver is defined in Chapter 3 and in footnote 9 of the revised SPM.
129933	12	30			Change "driver" to "drivers" [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
41241	12	31	12	31	GMSL - it would be useful to say what the rise is for the period since 1970 [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Noted. We now provide rate of change for different periods.
38913	12	33	12	33	"Strengthening" usually has a positive connotation. Would it be possible to say "is becoming more severe"? [Maike Nicolai, Germany]	Taken into account. Text rewritten to avoid any such connotation

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111641	12	33	12	33	P 8 L 35-36 seems to suggest that the ocean CO2 uptake strength has declined. These two sentences need to be consistent. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The text has been split across HS1 and HS2 which should reduce the potential for ambiguous interpretation and both statements revised for clarity
111459	12	33	12	33	Remove "the" at the end of the line. [James Renwick, New Zealand]	Editorial
34517	12	33	12	33	Repeating an earlier comment, the average pH of the ocean is about 8.1, whereas a pH less than 7 is acidic, so ocean water is slightly basic. A more precise choice of words would be, "The ocean has increased in relative acidity." Having said that, it's noteworthy that this sentence does not provide the actual increase in acidity, which is on the order of 25-30% as I recall. [Russell Vose, United States of America]	Taken into account. Much of this detail is not possible in the SPM but aspects have been incorporated in the redraft where possible.
108257	12	33	12	33	I would understand "acidification strengthening" as an acceleration. Is that what is meant? Or is it rather "Ocean acidity is declining"? [Johannes Quaas, Germany]	Taken into account. Phraseology changed for clarity
108549	12	33	12	34	Unclear, could these lines be re-worked. I had trouble understanding what was being said. [Jason Donev, Canada]	Accepted. Text rewritten for clarity.
36409	12	33	12	34	This statement only refers to the decade between 2009-2018. It does not refer to a "continuing" rate. [Adrienne Sutton, United States of America]	Taken into account. The text has been partitioned across HS1 and HS8 and clarified
15431	12	33	12	34	Re: Ocean acidification is strengthening as a result of the ocean continuing to take up $23 \pm 6\%$ of the global anthropogenic CO2 emissions (high confidence). This statement seems to be weaker than the statement in the Executive Summary of Chapter 3: It is virtually certain that the uptake of anthropogenic CO2 has substantially contributed to the acidification of the global ocean (Ch.3, P.6, lines 28-29). Please consider revision. [SAI MING LEE, China]	Accepted. Text redrafted accordingly
54631	12	33	12	34	The verb tense of this sentence ("continuing to take up") makes it unclear over what time period the uptake by the ocean of 23% of anthropogenic CO2 is valid. Recommend revising to clarify the time period(s) over which this result is true. [Nancy Hamzawi, Canada]	Accepted. Text substantively rewritten for clarity
44731	12	33	12	34	"continuing" is unclear by itself, it sounds like referring to the future. Over which time period? [Markku Rummukainen, Sweden]	Taken into account. Changed phrasing should remove this ambiguity
28159	12	33	12	34	It would be helpful to explain here the reason why ocean takes up 90% of energy imbalance (box), but only 23% of CO2 emissions. [Eric Brun, France]	Rejected. This is covered in HS4
37517	12	33	12	36	Your claims are laughable given that the supposed change falls within the error margin of the methods used to measure pH, especially those of the early 20th century. Further, you have no evidence that the ocean is taking $23 \pm 6\%$ (that's a big range!) of specifically anthropogenic CO2 because no-one can know how much anthropogenic CO2 is in the atmosphere. The absorption of CO2 will be governed by the partial pressure of CO2 in the atmosphere, by the temperature of the surface and by the amount falling out to the ocean floor or being absorbed by marine life. I doubt that it is possible to know the change caused by any one factor, let alone all four. [John McLean, Australia]	Rejected. The text is firmly grounded in the underlying assessment and the literature.
37519	12	33	12	36	Quantify the change in pH so that readers can see how small it is. [John McLean, Australia]	Rejected. Quantification not possible given the request from governments for brevity.
50181	12	33	12	38	Ocean acidification and deoxygenation are two separate processes; including them both in B3.3 is confusing as it suggests they are linked. The sentence on deoxygenation could be either separated into its own section, or included in the section on stratification where it is better linked. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Space considerations require them to remain considered together but the reformulation in HS1.7 is hopefully clearer

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104101	12	33	12	38	B3.3 could be more quantitative on pH and levels of deoxygenation. [Philippe Tulkens, Belgium]	See 37519
8115	12	33	12	38	B3.3 could be more quantitative on pH and levels of deoxygenation. [Frank Dentener, Italy]	See 37519
86947	12	33	13	7	We are happy to see results on ocean acidification, deoxygenation and AMOC clearly highlighted in the SPM [Oyvind Christophersen, Norway]	Noted.
27843	12	34	12	36	Please specify what is the amount of pH decline. [Eric Brun, France]	Rejected. Space constraints preclude such inclusion
89819	12	34			Please quantify the magnitude of pH change. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	See 27843
38915	12	36	12	36	Who could have "experienced" a low pH two million years ago? Perhaps swap "experience" and "occur"? [Maike Nicolai, Germany]	Accepted. Text modified
50187	12	36	12	36	Suggest that it would also be worthwhile clarifying here that deoxygenation occurs as a result of ocean warming (and other factors). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints preclude such inclusion
111461	12	36	12	36	Change to "...that today's surface pH values have not been experienced..." [James Renwick, New Zealand]	Taken into account. Text redrafted although not precisely as suggested.
104103	12	36	12	38	Please add a line on the main (climate) drivers of deoxygenation, as not all policy makers may know this. [Philippe Tulkens, Belgium]	See 50187
8111	12	36	12	38	Please add a line on the main (climate) drivers of deoxygenation, as not all policy makers may know this. [Frank Dentener, Italy]	See 50187
25827	12	36	12	38	It would be useful to define Oxygen Minimum Zones (OMS) and its consequences on the biosphere. Some information on this can be found in chapter 5, pages 48-49. [Don Alfonso Pino Maeso, Spain]	Rejected. Space constraints preclude such inclusion
36117	12	36			Some explanation of ocean warming and stability would be helpful. Now low oxygen is unexplained. Maybe put this after B.3.4' stratification. [Michael PRATHER, United States of America]	See 50187
7681	12	37	12	37	It is suggested to substitute "upper km" by "upper 1000m" in order to use the same units for the ocean depth as in the other paragraphs above. [Klaus Radunsky, Austria]	Not applicable. In redrafting the various depth references have been removed
65547	12	37	12	37	Suggest changing the text to: "upper 1 km of open ocean". [Kushla Munro, Australia]	See 7681
50189	12	37	12	37	It would be useful to quantify here how much deoxygenation has increased in upper km of open ocean since 1970 (and if the rate has increased over the observation era?). Some quantification of how the volume of oxygen minimum zones have increased would be helpful too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints preclude such inclusion
24411	12	37	12	37	upper km? [Zhou Botao, China]	See 7681
111463	12	37	12	37	Change to "kilometre" or "1 km" [James Renwick, New Zealand]	See 7681
129935	12	37	12	37	Add "1" to "upper (1) km" for clarity. [Trigg Talley, United States of America]	See 7681
38917	12	40	12	40	It might be helpful to explain what "near-surface" and "sub-surface" means (metres depth). [Maike Nicolai, Germany]	Not applicable. The terms have been removed
50191	12	40	12	40	Suggested edit for clarity: 'It is extremely likely that human influence has contributed to warming that has led to observed near-surface and subsurface oceanic salinity changes since the mid-20th century' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been entirely changed
31593	12	40	12	40	if subsurface salinity change is assessed very likely in chap 2, it appears odd to assess attribution of the change to extremely likely. Needs to be clarified between Chap 2 and 3, in concert with chap 9. [Jean-Baptiste SALLEE, France]	Noted. We confirm the consistency with all underlying chapters

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50183	12	40	12	44	It is unclear what unit/how stratification is measured in, making it difficult to give context on the 5-20% figure. Please could you clarify this here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Stratification assessment has been removed
37715	12	40	12	44	The paragraph discusses changes in salinity, but the direction of the change is not mentioned. [Stephanie Arcusa, United States of America]	Noted. The direction of change is regionally dependent. We now only focus on attribution of these change to avoid confusion and lengthy text. However all details can be found in underlying chapters
104105	12	40	12	44	B3.4 can report values of salinity change. [Philippe Tulkens, Belgium]	Rejected. The direction of change is regionally dependent. We now only focus on attribution of these change to avoid confusion and lengthy text. However all details can be found in underlying chapters
8117	12	40	12	44	B3.4 can report values of salinity change. [Frank Dentener, Italy]	Rejected. The direction of change is regionally dependent. We now only focus on attribution of these change to avoid confusion and lengthy text. However all details can be found in underlying chapters
108259	12	41	12	41	In the Box B2 (page 9, lines 40-41) we concluded with “high confidence” that the water cycle has strengthened. In light of this, I think we should write “patterns that reflect an intensification” rather than the mere “suggest” [Johannes Quaas, Germany]	Not applicable. Text has been entirely changed
53473	12	41	12	42	replace "suggest" by "is consistent with an overall intensification of the water cycle" since there is multiple and more direct evidence. [Hervé Douville, France]	Not applicable. Text has been entirely changed
50193	12	42	12	42	Suggested addition for clarity: oceanic salinity changes since the mid-20th century with spatial patterns that suggest an intensification of the water cycle through combination of increased surface evaporation and higher water carrying capacity of a warming atmosphere (high confidence)' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been entirely changed
38919	12	42	12	43	Could you explain what "surface-intensified" means or rephrase? [Maike Nicolai, Germany]	Not applicable. Text has been entirely changed
61349	12	42	12	44	The medium confidence expressed here is not consistent with the statements made in Sect. 9.2.1.4. For the SROCC stratification increase estimates you give a 'very likely' probability (page 17, line 11). You confirm later that the upper ocean stratification has 'very likely' increase since 1970 (page 17, line 19). Yet you give 'high confidence' on the increase in summer pycnocline of 5-20% (line 20). Note that you specify there the 'summer' pycnocline in contrast to theSPM. Please check consistency on confidence and terminology. [APECS, MRI, PAGES ECN, PYRN and YESS ECS group review, Canada]	Not applicable. Stratification assessment has been removed
61351	12	42	12	44	The Sect. references given seem inappropriate. The anthropogenic influence on the salinity is formulated in Sect. 9.2.2.2 (page 25, line 37-39). The stratification increase of 5-20% is forwarded in 9.2.1.4 (page 17, line 20). [APECS, MRI, PAGES ECN, PYRN and YESS ECS group review, Canada]	Noted. Reference to sections have been carefully checked to be consistent with reformulated text

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68535	12	42	12	44	This statement about upper ocean stratification increasing by 5%-20% per decade between 1970 to 2018 is traceable back to a single reference that has been submitted, but not accepted. The precise metric of stratification is never described in the body of the chapter text in a way that could be reproduced (in the underlying paper "the summer pycnocline" is the summertime density difference over the 15 m below the diagnosed mixed layer depth), and the upper end of 20%/decade compounded over 50 years give a ~2.5 fold increase in the stratification over this period, which is not broadly supported in the literature. Moreover, this single reference has factor of two differences in the estimates of the percentage change in the zonal mean stratification, compared the zonal mean of the percentage change in diagnosed stratification, with the largest value for change the one that is reported here. I suspect that there is the potential that these findings could be strongly impacted by changing observational techniques (e.g., falling instrument response rates) and data distributions. This magnitude of change is at odds with other findings both from SROCC and from Chapter 9. Extraordinary claims require extraordinary proof, and this entire line in the SPM would have to be eliminated if this single publication is not accepted or is later retracted. The increased upper ocean stratification is a critical aspect of the oceanic manifestations of climate change, upon which many ecological changes depend, and I urge the authors to use metrics and language that are _broadly_ supported by the oceanographic literature, so that this key point will move smoothly through the government approval process. [Robert Hallberg, United States of America]	Not applicable. Stratification assessment has been removed
25831	12	42	12	44	It would be helpful to explain the figure of 5-20% increase of stratification of the upper ocean per decade. Chapter 3, page 48, lines 13-15 appear to have different figures: "SROCC augmented these insights, noting that observed high latitude freshening and warming have very likely made the surface ocean less dense with stratification increase of between 2.18 and 2.42% from 1970 to 2017" [Don Alfonso Pino Maeso, Spain]	Not applicable. Stratification assessment has been removed
69355	12	42	12	44	The implication of the latest assessment of a rate per decade of the stratification as stated in Executive Summary in Chapter 9 (page 5, line 30-31 "more than ten times higher than reported by SROCC") should be added. Otherwise, the SPM would lose the balance in Chapter 9. [Kaoru Magosaki, Japan]	Not applicable. Stratification assessment has been removed
17459	12	42			an intensification of the water cycle' - this needs to be explained. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been entirely changed
104107	12	43	12	43	The metric used for quantifying change in stratification should be given, perhaps in a footnote. [Philippe Tulkens, Belgium]	Not applicable. Stratification assessment has been removed
25829	12	43	12	43	It would be useful to explain the concept of "stratification" the first time it appears in the text. [Don Alfonso Pino Maeso, Spain]	Not applicable. Stratification assessment has been removed
12653	12	43	12	44	This is not consistent with what has been shown in chapter-9, where stratification is only calculated at the base of mixed layer, which is a very limited layer and a very small part of ocean region, so the quantification in chapter-9 can not represent "ocean stratification", instead, it represents ocean stratification at a specific layer of ocean. This statement sounds like it is about global ocean stratification. [Lijing Cheng, China]	Not applicable. Stratification assessment has been removed

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12655	12	43	12	44	The number here 5~20% per decade shows a huge difference compared with SROCC and AR5 (which are <=1% per decade). That means ocean stratification has increased up to 100% in the past 50 years according to AR6 (this is huge and media will pick this up), such an extraordinary statement must be backup-ed by extraordinary evidence, which is not for now. So I have strong reservation to this assessment based on a single and unpublished study, I will detail my comments in chapter-9. [Lijing Cheng, China]	Not applicable. Stratification assessment has been removed
81889	12	43	12	44	A policymaker may not know what increased stratification means. I suggest providing an example or providing an explanation in parantheses. E.g. (mixing of upper ocean water masses) [Dan Zwartz, New Zealand]	Not applicable. Stratification assessment has been removed
17461	12	43			stratification' needs to be explained. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Stratification assessment has been removed
50195	12	44	12	44	Would it be possible to add some details of implications of stratification on other ocean processes, for example 'Increased stratification leads to decreased deep ocean circulation and can lead to a slowing down of ocean mixing'? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Stratification assessment has been removed
9495	12	44	12	44	The intensification of the water cycle is mentioned in B3.4 but no cross reference to chapter 8 on water cycle changes. Suggest referring to section 8.2 and 8.3 [Joelle Joelle Gergis, Australia]	Not applicable. Water cycle change has been removed from this bullet
69357	12	44	12	44	It would be better to add "9.2.1" as the reference. [Kaoru Magosaki, Japan]	Not applicable. Bullet point removed, to shorten SPM.
27847	13	1	13	1	We suggest to mention the consequences on the Gulf Stream here, if there are any. [Eric Brun, France]	Accepted. Some details added.
32891	13	1	13	2	The statement that the AMOC has weakened since about 2005 is wooly. Smeed et al. (2014) observed a decline 2004-2012, and with a longer time series Smeed et al. (2018) concluded that that it was in a reduced state 2008-2017 as compared to the earlier observations 2004-2008. [Meric Srokosz, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The AMOC statements have been rewritten and assessments revised
27845	13	1	13	2	If possible, please indicate here what could be the physical/climatic consequences of such weakening of the AMOC. [Eric Brun, France]	Accepted. Some details added.
90179	13	1	13	6	Paragraph B3.5 seems not policy-relevant for us and can be skipped. Include the first sentence "Direct observations show that the Atlantic Meridional Overturning Circulation (AMOC) has weakened since about 2005 (high confidence)." to Para B3.2. [Georges Gehl, Luxembourg]	Not applicable. This sentence has been rewritten.
104109	13	1	13	6	Suggest to start with the 20th century evidence, and then the stronger 21st century evidence. The statement implicitly seems to suggest that there are only observed changes in the Southern and Atlantic oceans. It could explicitly mention the absence of detectable change in other oceans, and what that implies. [Philippe Tulkens, Belgium]	Noted. The AMOC statements have been rewritten and assessments revised
104111	13	1	13	6	B3.5 would benefit from quantification and providing context.How much did AMOC decline, is that much or not, and what are the possible consequences. [Philippe Tulkens, Belgium]	Noted. The AMOC statements have been rewritten and assessments revised
8113	13	1	13	6	Suggest to start with the 20th century evidence, and then the stronger 21st century evidence. The statement implicitly seems to suggest that there are only observed changes in the Southern and Atlantic oceans. It could explicitly mention the absence of detectable change in other oceans, and what that implies. [Frank Dentener, Italy]	Noted. The AMOC statements have been rewritten and assessments revised
8119	13	1	13	6	B3.5 would benefit from quantification and providing context.How much did AMOC decline, is that much or not, and what are the possible consequences. [Frank Dentener, Italy]	Noted. The AMOC statements have been rewritten and assessments revised

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104385	13	1	13	6	SPM should note that the changes are consistent with theory and some model projections as a response to anthropogenic forcings [Hunter Cutting, United States of America]	Noted. The AMOC statements have been rewritten and assessments revised. Comparisons to theory come in Chp 9
111643	13	1	13	7	Overall I thought this paragraph was spot on. However the reference to the Southern Ocean in line 5 comes from nowhere and I was left wondering what S Ocean changes are being discussed. I think S Ocean needs to be expanded or deleted. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This sentence has been rewritten.
50211	13	1	13	7	It would be helpful here to elevate a line from the Chapter 9 Executive Summary (pg 5, line 37) "Robust observed changes in the Atlantic Meridional Overturning Circulation (AMOC) are not presently linked to anthropogenic causes, but the AMOC will likely decline in response to human induced climate change in all scenarios". [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The AMOC statements have been rewritten and are closer to this suggestion.
88895	13	1	13	7	I am not sure why the changes are assessed with confidence statements after which is stated that it could all be natural variability. Furthermore, not that a paper coming out soon shows that the North Atlantic warming hole is not strong evidence of a declining AMOC, but instead is more closely linked to an accelerating high latitude circulation in the historical setting (Keil et al. 'Multiple drivers of the North Atlantic warming hole). [Thorsten Mauritsen, Sweden]	Noted. The AMOC statements have been rewritten and assessments revised
23375	13	1	13	7	Since the observed change in the AMOC is mentioned in the first sentence it is confusing that with respect to the Southern Ocean, only an attribution statement is made without anything on the nature and direction of observed change. [Anna Amelia Sörensson, Argentina]	Not applicable. This sentence has been rewritten.
105585	13	1	13	7	I just cut-and-paste the SROCC statement here for reference "Observations, both in situ (2004–2017) and based on sea surface temperature reconstructions, indicate that the Atlantic Meridional Overturning Circulation (AMOC) has weakened relative to 1850–1900 (medium confidence). There is insufficient data to quantify the magnitude of the weakening, or to properly attribute it to anthropogenic forcing due to the limited length of the observational record. Although attribution is currently not possible, CMIP5 model simulations of the period 1850–2015, on average, exhibit a weakening AMOC when driven by anthropogenic forcing." [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The comparison to the SROCC assessment comes in Chp 9. The assessments differ somewhat, particularly surrounding the projections due to new information from CMIP6 and OSNAP
54641	13	1	13	7	B.3.5 On Ocean circulation seems not in phase with what presented in Chapter 9 (p. 9-5, paragraph starting L.37). The former says that the AMOC weakened since 2005 while the latter says that the weakening between 2003-2011 is within natural range of variation. Double check the wording to be consistent (or remove bullet). [Nancy Hamzawi, Canada]	Noted. The AMOC statements have been rewritten and assessments revised

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129937	13	1	13	7	For the discussions on AMOC, it may be helpful in the SPM to translate for policymakers what the impacts of a decreased AMOC would have on oceanic productivity. For example, in the SROCC B2.7 of the SPM, it is mentioned that "Any substantial weakening of the AMOC is projected to cause a decrease in marine productivity in the North Atlantic (medium confidence), more storms in Northern Europe (medium confidence), less Sahelian summer rainfall (high confidence) and South Asian summer rainfall (medium confidence), a reduced number of tropical cyclones in the Atlantic (medium confidence), and an increase in regional sea level along the northeast coast of North America (medium confidence). Such changes would be in addition to the global warming signal." [Trigg Talley, United States of America]	Accepted. Some details added.
129939	13	1	13	7	Alternative analyses of AMOC show that it is dominated by natural variability and any trend is likely spurious (because of inhomogeneities in RAPID array) and magnitude too large. See Trenberth, K.E., and J.T. Fasullo, 2017: Atlantic meridional heat transports computed from balancing Earth's energy locally. Geophys. Res. Lett., 44, 1919--1927, doi:10.1002/2016GL072475. Also, more up to date: Trenberth, K. E., Y. Zhang, J. T. Fasullo, and L. Cheng, 2019: Observation-Based Estimates of Global and Basin Ocean Meridional Heat Transport Time Series. J. Climate, 32, 4567--4583, https://doi.org/10.1175/JCLI-D-18-0872.1 [Trigg Talley, United States of America]	Noted. The AMOC statements have been rewritten and assessments revised
86465	13	1	13	7	A nice, clear and concise statement about AMOC. Thanks [Ala Taimar, Estonia]	Noted.
42217	13	1	13	7	B3.5: Clear and important message on AMOC. [Tina Christensen, Denmark]	Noted. The AMOC statements have been rewritten and assessments revised
97261	13	1	13	7	Paragraph B3.5 should be shortened. The text following "low confidence" in line 3 is only giving explanations for the low confidence statement. It is not done accordingly with other low confidence statements and reads like justification. [Nicole Wilke, Germany]	Not applicable. The AMOC statements have been rewritten and assessments revised
53475	13	1	16	6	complete the last sentence with: "although some models do suggest a human influence."? [Hervé Douville, France]	Not applicable. The AMOC statements have been rewritten and assessments revised
41243	13	2	13	2	"weakened" - it would be useful to say by how much. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There is an FAQ and glossary definition and chapter text in Chps 4, 9 to explain these consequences.
50203	13	2	13	2	Observations show that the AMOC has weakened' - it would be helpful to briefly add here why quantifying this weakening based on available observations is challenging. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Some details added.
25833	13	2	13	2	According to chapter 2, page 71 line 42 it should be 2005-2008 instead of 2005. [Don Alfonso Pino Maeso, Spain]	Not applicable. The AMOC statements have been rewritten and assessments revised
81829	13	2			Is the use of "further" (as in "There is further evidence of AMOC weakening") is ambiguous. Is this "further evidence" since AR5? Or is this "further evidence" to what is included in the first sentence of the paragraph? If it is the former, then "since AR5" needs to be added. If it is the latter, suggest a slight rephrasing of the beginning of the sentence "In addition there is evidence of AMOC weakening" or "There is also evidence of AMOC weakening" [Dan Zwartz, New Zealand]	Not applicable. The AMOC statements have been rewritten and assessments revised
89821	13	2			Please quantify the magnitude of AMOC change. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There is an FAQ and glossary definition and chapter text in Chps 4, 9 to explain these consequences.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36119	13	3			large method uncertainties' is what? [Michael PRATHER, United States of America]	Not applicable. The AMOC statements have been rewritten and assessments revised
42651	13	3			Large method uncertainties' - presumably this means large uncertainties in the methods used to estimate the AMOC. If so, would be good to make this explicit. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The AMOC statements have been rewritten and assessments revised
31559	13	4	13	6	I think it is good to have SO here, and I suggest to keep it as it is a matter of concern with large climate implication. However before arguing that we are unsure if change in SO circulation are due to internal/natural var, I would add mention on the change itself, and ascribing low confidence due to indirect measure, similar to what is done for AMOC for the 20th century. [Jean-Baptiste SALLEE, France]	Not applicable. The S. Ocean comments have been removed.
129941	13	4	13	6	The earlier part of the paragraph did not mention any observed changes in the Southern Ocean. [Trigg Talley, United States of America]	Not applicable. Bullet point removed.
36121	13	4			This is confusing. Are the observed changes large? of unusual pattern? Are they obvious? The length of the record is secondary [Michael PRATHER, United States of America]	Not applicable. The AMOC statements have been rewritten and assessments revised
17463	13	10	13	51	What's new since the publication of SROCC? Or is information presented here in such a way as to provide policymakers with a different insight? It should be made clear. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	The new version of the SPM now introduced all three SRs in the introduction. Please see the Technical Summary for key updates from the AR5 WGI and the three Special Reports. The new version of the SPM now introduced all three SRs in the introduction but does not callout to any of the SRs in the line of sight. Assessments that build on the SR findings are clearly shown in the citations of the underlying chapters.
104113	13	10	13	52	The section B.4 about cryosphere should be complemented with figures about the area and the volume of described phenomena: permafrost thawing, ice-sheet reductions, mountain permafrost... [Philippe Tulkens, Belgium]	Not applicable. The structure and narrative of the SPM has been completely revised and we no longer have a cryosphere section, instead the different components of the earth system are presented in a much more integrated way. Note that the figures have been completely revised to produce a consistent visual narrative that supports the SPM and that figure SPM.8 shows sea ice.
104387	13	10	13	52	The SPM should note the observed loss of snowpack due to warming temperatures, particularly in high mountain areas, as that snowpack is a major sources of water supplies in several regions. [Hunter Cutting, United States of America]	Taken into account. Snow pack implicitly mentioned in fig SPM.9, panel a. Note however that the revised SPM is much more concise, which implied choice on what to present and not to present.
27849	13	10			Globally, this section is too qualitative. It would be useful to give more quantitative values of the losses of the cryosphere and of the accelerartion of this loss. It cannot be assumed that the readers of this SPM will all have read the SROCC SPM. [Eric Brun, France]	Taken into account. Quantities have been added throughout the SPM, wherever possible.
50205	13	12	13	19	I think the Antarctic (area and mass) change needs to be represented in headline statement B4, to ensure representation of the B4 statements below. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of new section 'state of the climate' (former section B) has been completely revised and the headline statements are not sorted by component of the climate system anymore.
17465	13	12	13	19	If this box is part of overarching highlighted conclusions, providing a concise summary, then surely a line on the Antarctic Ice Sheet and possibly Antarctic sea ice needs to be in here. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90181	13	12	13	19	The first two sentences seem to us the main messages of this headline, namely "Over the past decades, pervasive loss of ice sheet and glacier mass, snow cover extent and sea-ice area, as well as increases of permafrost temperature have been observed. The Greenland Ice Sheet, Arctic sea ice and glaciers in many regions are now in states unprecedented over centuries or more (high confidence)." The last sentence seems at first sight in contradiction to the headline of section B.3. If kept we suggest to reformulate: "The contribution of glacier and ice sheet loss to global sea level rise has become more important during the last decades and has likely contributed to half of the global sea-level rise since 1993." [Georges Gehl, Luxembourg]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
83359	13	12	13	19	Please include information about change in the Antarctic Ice Sheet and Antarctic sea ice in this box. [Robert Massom, Australia]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
106697	13	12	13	19	Why is there any sentence about the Antarctic ice sheet in this box? Even if the Antarctic ice sheet has undergone less changes than other components of the cryosphere over the last decades, it would be relevant to give some explanations about this component. [Kevin Bulthuis, United States of America]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
87253	13	12	13	19	Information on the Antarctic ice sheet is missing in the bold text [Marcel Berk, Netherlands]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
97263	13	12	13	19	The highlighted paragraph should include some information on the Antarctic. [Nicole Wilke, Germany]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
108555	13	12	13	38	For this audience, make the difference between sea ice and land ice more clear. [Jason Donev, Canada]	Noted.
34977	13	12	13	38	The SOD claims an unprecedented loss in Arctic sea ice over the last 1000 years. Please see rebuttal comment #7 above. [Jim O'Brien, Ireland]	Noted. This statement is grounded in Chapter 9 though.
53477	13	13			replace "permafrost temperature" by "permafrost temperature and thawing"? [Hervé Douville, France]	Not applicable. Headline statement completely rewritten, sentence no longer appears.
54643	13	15	13	15	Suggest mentioning Antarctic Ice Sheet in the summary box e.g. "... confidence). [The Antarctic Ice Sheet is also losing mass.] Human influence was very likely the dominant cause of the observed reduction in Arctic ..." [Nancy Hamzawi, Canada]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
86949	13	15	13	18	Please consider to include "ongoing" before "observed reduction in the Arctic ...". In addition, you should consider if "observed" in line 16 could be deleted. In the current formulation it is slightly odd that "observed" is only linked with two/three out of four things mentioned. We believe that having observed mentioned once in the sentence up front is sufficient. [Oyvind Christophersen, Norway]	Not applicable. Headline statement completely rewritten, sentences no longer appear.

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86951	13	15	13	18	By using past tense in this statement readers could be mislead to think that these changes have stopped. Regarding the way human influence is formulated in the SPM, we have a preference for how it is formulated in the B.5 highlighted conclusion. The sentence under B.4 could be similarly formulated to read " It is very likely that human influence is the dominant cause of the ... ice, and very likely a major/significant/important contributor/cause/reason to/for the ... four decades, and likely a major/significant/important contributor/cause/reason to/for the ... Greenland.". By building the sentence in such a manner it is in our view more apparent for readers that human influence already has, and will continue to affect these features. [Oyvind Christophersen, Norway]	Taken into account. HS.1.5 uses present-tense "Human influence is very likely the main driver of the global retreat of glaciers since the 1990s". Not however that human attribution studies are always on past periods/events.
11585	13	16	13	16	Replace ",and " by full stop [Gerhard Krinner, France]	Editorial. Not applicable. Sentence completely rewritten.
44733	13	16	13	16	"contributed" is vague, it does not indicated any order of magnitude or size of contribution. Could this be made more explicit? [Markku Rummukainen , Sweden]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
108553	13	18	13	19	This seems inconsistent with SPM-12 lines 4-5 [Jason Donev, Canada]	Taken into account. In the revised SPM, HS1.7 is about sea level , rate of rise and human attributions while HS4.3 is about the different sea level contributors.
18719	13	18	13	19	Please check if ocean expansion or glacier & icesheet melting is the largest contributor to sea level rise since 1993. [Govindasamy Bala, India]	Taken into account in the final version. A.4.3 of the approved SPM says "Thermal expansion explained 50% of sea level rise during 1971–2018, while ice loss from glaciers contributed 22%, ice sheets 20% and changes in land-water storage 8%. The rate of ice-sheet loss increased by a factor of four between 1992–1999 and 2010–2019"
23377	13	18	13	19	A related statement is found in the B.3.2: "Global mean sea level (GMSL) has risen by 0.19 m (likely 0.15–0.22 m) between 1900 and 2018 mostly from ocean thermal expansion and glacier melt." It would be better to collect all on GMSL rise in one place so that the relative roles of the two factors (thermal expansion and glacier melt) are clear - and if the roles have changed with time (my interpretation is that glacier and ice sheet melt have gained importance after 1993, but it is not really clear). [Anna Amelia Sörensson, Argentina]	Taken into account. In the revised SPM, HS1.7 is about sea level , rate of rise and human attributions while HS4.3 is about the different sea level contributors.
105587	13	18	13	19	Suggest to cross-check statement on glaciers being largest contribution to sea-level rise with B.3.2. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in the final version. A.4.3 of the approved SPM says "Thermal expansion explained 50% of sea level rise during 1971–2018, while ice loss from glaciers contributed 22%, ice sheets 20% and changes in land-water storage 8%. The rate of ice-sheet loss increased by a factor of four between 1992–1999 and 2010–2019"

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129943	13	18	13	19	Verify the statement that "Glacier and ice sheet loss has likely been the largest contributor to global sea level rise since 1993." Do authors mean instead that "Glacier and ice sheet loss has likely been the largest contributor to the ACCELERATION in global sea level rise since 1993"? The rate of rise of GMSL is about 3mm/yr. Readers are told in B.4.1 and B.4.2 that glacial and ice sheet loss since the 1990s have each contributed about 17 mm total change (over about a 27-yr period). So their sum effect is a little above 1mm/yr, which is only about 1/3 of the total rate of rise. The work by Steve Nerhem at CIRES does indicate that the glacial and ice sheet melts are what is driving the acceleration of GMSL rise in recent decades. [Trigg Talley, United States of America]	Taken into account in the final version. A.4.3 of the approved SPM says "Thermal expansion explained 50% of sea level rise during 1971–2018, while ice loss from glaciers contributed 22%, ice sheets 20% and changes in land-water storage 8%. The rate of ice-sheet loss increased by a factor of four between 1992–1999 and 2010–2019"
106695	13	18	13	19	Glacier and ice sheet ... the largest contributor ... since 1993: Though I am not an expert regarding the different contributions to sea-level rise, I find this sentence a little bit awkward/unclear. How does the contribution of the cryosphere to sea-level rise compare with the contribution due to thermal expansion. I would argue that they are pretty much similar and if we consider the contribution of glaciers and the Greenland ice sheet separately, then sea-level rise due to thermal expansion is the largest contributor. [Kevin Bulthuis, United States of America]	Not applicable. SPM completely revised and sentence no longer appears. Note that HS4.3 should be clearer on the different contributions to sea level rise.
36123	13	18			This last tidbit may be true but it follows talk about ocean warming being largest (yes different time ranges), but selecting time frames to discuss one effect seems dangerous. [Michael PRATHER, United States of America]	Noted.
132613	13	22	13	22	Does "retreated" mean decreased in spatial extent? Or loss of mass? Perhaps clarify. [Kyle Armour, United States of America]	Taken into account. Text clarified and simplified
50213	13	22	13	22	It would be helpful here to provide clarification of 'retreated overall' versus the virtual certainty of mass loss. Does the first term mean a loss in overall area? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified
111465	13	22	13	22	Change to "has retreated overall" [James Renwick, New Zealand]	Taken into account. Text clarified and simplified
129945	13	22	13	22	Strike the first sentence of the summary to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Accepted. Sentence removed and SPM much shorter.
97265	13	22	13	22	Please state the reason why the GrIS retreated since 1850, to avoid confusion (natural or anthropogenic), and add the fraction of mass loss caused by anthropogenic forcing for last 20 years or so. [Nicole Wilke, Germany]	Taken into account. We now use an integrated measure of ice sheet loss
38921	13	22	13	23	This might be misunderstood: If the Greenland Ice Sheet has been retreating since 1850 and has lost mass since 1990 - has it become thicker between 1850 and 1900? Does "overall" mean that it sometimes grew and sometimes shrunk, but was smaller in 1900 than in 1850? Or do the two statements about 1850 and 1900 refer to different data that are available? Please clarify. [Maike Nicolai, Germany]	Taken into account. Text clarified and simplified
41299	13	22	13	23	It should be made more clear what the difference between "overall retreat since 1850" and "lost mass since the 1990" is, and why this distinction was made. The non-specialist reader would ask: "If there was overall retreat since 1850, there should also be mass loss since 1850"? [Alexander Nauels, Germany]	Taken into account. Text clarified and simplified
50199	13	22	13	27	It is unclear why there is only medium confidence that Antarctic ice sheet mass loss has accelerated over the last decades, when comparing to similar statements in SROCC, such as A3.2 of the SPM of that report which states as fact that mass loss from Antarctic ice sheet tripled in 2007-2016 relative to 1997-2006. Please could you clarify the reason for the discrepancy between reports. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text clarified and simplified

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15433	13	22	13	27	The accelerated ice losses of the Greenland and Antarctic Ice Sheets corresponding to the sea-level rise contributions during 1992-2018 are huge, i.e. 3800 Gt from Greenland (Ch.2, P.62, line 34) and about 2500 Gt from Antarctica (Ch.9, P.58, line 54). These significant changes are suggested to be reflected in the Summary for Policymakers. Acceleration of ice loss of Greenland should also be mentioned (Ch.9, Figure 9.18). "since at least since" in line 25 should read "since at least". [SAI MING LEE, China]	Taken into account. Text clarified and simplified
37521	13	22	13	27	Report only the facts, not the speculations. If figures are estimates then say so. [John McLean, Australia]	The Assessment is reported
34979	13	22	13	27	The SOD claims that the Greenland ice sheet state is unprecedented over centuries. Please see rebuttal comment #8 above. [Jim O'Brien, Ireland]	Taken into account. Text clarified and simplified
86953	13	22	13	27	Please consider providing assessment of trends in ice mass loss also for Greenland Ice Sheet, i.e. whether ice loss is accelerating or not. [Oyvind Christophersen, Norway]	Taken into account. Text clarified and simplified
10187	13	22	13	27	GrIS has also accelerated - weird to mention this only from AIS. (Ch 9: Greenland was likely close to mass balance in the 1990s and there is high confidence that annual mass losses have been consistently negative since the early 2000s.) [Robert Kopp, United States of America]	Taken into account. We now use an integrated measure of ice sheet loss
65551	13	22	13	32	Suggest converting the absolute estimates of sea level contributions over the different time intervals to sea-level rise rates per year or decade, while also still specifying the time intervals. This will ensure they are directly comparable. [Kushla Munro, Australia]	Taken into account. Text clarified and simplified
17585	13	22	13	32	A fair balance of evidence is missing. As an example, Jakobshavn, the largest glacier in Greenland is growing since 2016. Also missing is historical perspective : the so-called losses are less than 0,0005% of total Greenland ice mass. Could well be within measurement errors and caused partly by natural variations due to mainly ocean currents as mentioned in relevant literature. For West-Antarctica ice calving is caused by the geothermal heat source deep below the surface, well known in relevant literature. Not mentioning this is good example of selection bias in favour of AGW-alarm. [ferdinand meeus, Belgium]	Rejected. The claims in this comment do not fit with the peer reviewed assessment in chapter 9
34519	13	22	13	51	Sea-level increases in the Cryosphere section are given in mm whereas they are listed in meters in the Ocean section (B3.2). [Russell Vose, United States of America]	Taken into account. We now use an integrated measure of ice sheet loss
27851	13	23	13	24	Consider mentioning what percentage this represents of the total sea level rise. We suggest: "this accounts to grossly half the sea level rise over the period". [Eric Brun, France]	Taken into account. We now use an integrated measure of ice sheet loss
129947	13	23	13	27	[PRECISION] Recommend using consistent units for Sea-Level Rise throughout the chapters. For example, in the SPM the authors use mm while the authors of Chapter 9 using m when describing impacts on sea-level rise due to the Greenland Ice Sheet loss. Similar comment for Antarctica. [Trigg Talley, United States of America]	Accepted. metres are now used
129949	13	23	13	31	Consider focusing on one date range similar to the Chapter 9 Executive Summary. It is unclear in the SPM why those date ranges are included when not in the Chapter 9 summary. [Trigg Talley, United States of America]	Accepted. dates are used more uniformly
34981	13	24	13	27	The SOD claims that the Antarctic has lost ice mass since the early 1990s, but further down correctly admits that there is no significant trend. Please see rebuttal comment #9 above. [Jim O'Brien, Ireland]	Taken into account. We now use an integrated measure of ice sheet loss
36125	13	24			Here we find SLR being used and earlier it was GMSL change, adopt a consistent language. [Michael PRATHER, United States of America]	Taken into account. We now use an integrated measure of ice sheet loss

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7683	13	25	13	25	It is suggested to delete "since at least". [Klaus Radunsky, Austria]	Taken into account, text clarified
52233	13	25	13	25	since at least since: delete one since [Dominique Raynaud, France]	Taken into account, text clarified
52165	13	25	13	25	there are two "since" in this sentence. [Lucas Ruiz, Argentina]	Taken into account, text clarified
27853	13	25	13	25	There are two "since", which makes the sentence unclear. Please delete one. [Eric Brun, France]	Taken into account, text clarified
32881	13	25			The contribution of the AIS to sea level needs to be revised [Helene Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, text clarified
27855	13	26	13	26	Giving the value of acceleration here would be useful. [Eric Brun, France]	Taken into account. We now use an integrated measure of ice sheet loss
25835	13	26	13	26	Chapter 9, page 58, line 53 cites the period 1992-2016/2017 instead of 1992-2018. [Don Alfonso Pino Maeso, Spain]	Taken into account. We now use an integrated measure of ice sheet loss
69359	13	26	13	26	It would be useful for readers to add the reason why the Antarctic ice sheet mass loss has accelerated over the last decades. [Kaoru Magosaki, Japan]	Taken into account. We now use an integrated measure of ice sheet loss. Extra detail is in Chapter 9
41301	13	26	13	27	Multiple studies point to a very strong acceleration of AIS mass loss over the last decades that can be quantified (IMBIE etc). This medium confidence statement does not adequately capture scientific progress in observations and quantification of AIS mass loss and lacks the crucial quantitative information that can be provided. [Alexander Nauels, Germany]	Taken into account. We now use an integrated measure of ice sheet loss
50207	13	27	13	27	Antarctic ice sheet mass loss has accelerated over the last decades' - please could you specify from when, and the rate of change? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We now use an integrated measure of ice sheet loss. Extra detail is in Chapter 9
37495	13	27	13	27	Section 9.4 does not support your claim. That chapter ... "assesses past and possible future changes in the ocean, cryosphere and sea-level at the process-level using paleo-reconstructions, modern observations and model projections" and none of this amounts to evidence of any sort, let alone evidence to support your statement. [John McLean, Australia]	Rejected. Chapter 9 assessed the published evidence for sea-level rise
86955	13	28	13	55	Regarding Arctic summer sea ice area and northern hemisphere spring snow cover, please also consider to include assessments whether loss of summer sea ice area and arctic spring snow cover is accelerating on decadal scale. If current knowledge does not allow for such assessments, please inform. [Oyvind Christophersen, Norway]	Taken into account. We now use an integrated measure of ice sheet loss and sea-level. Extra detail is in Chapter 9
4551	13	29	13	30	The term "unprecedented" in the context of only the past 170 years should be avoided as it is alarmistic. Holocene climate is much longer and many glaciers were equally short during the Medieval Warm Period or completely absent during the Holocene Thermal Maximum. Please pay more attention to this wording and employ language in a more neutral way. [Sebastian Luening, Switzerland]	Taken into account in redrafting where greater specificity is now given in HS2.4
15435	13	29	13	32	The mass losses contributing to 25 mm (between 1971 and 2016) and 17 mm (between 1993 and 2018) global sea level rise are huge. It is suggested to reflect these significant changes in the Summary for Policymakers. [SAI MING LEE, China]	Rejected. This level of detail hard to justify at SPM level but is available in the TS and underlying chapters
104115	13	29	13	32	How much glacier mass was lost- fractional or absolute? [Philippe Tulkens, Belgium]	Rejected. We only have absolute values for a very short period of truly global monitoring. The longer term metrics concern whether glaciers are in advance or retreat but say nothing about absolute volume changes per se.
8121	13	29	13	32	How much glacier mass was lost- fractional or absolute? [Frank Dentener, Italy]	Repeat of 104115

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10189	13	29	13	32	Time periods seem arbitrary. [Robert Kopp, United States of America]	Noted. Time periods are driven by varying data availability. We have tried to be clearer in this regard
117215	13	29	13	32	Not sure why 2 different time periods are mentioned in this paragraph [Maisa Rojas, Chile]	Taken into account. Splitting into HS.1 and HS.2 has resolved.
97267	13	29	13	32	Please state the reason why the glaciers retreated since 1850, to avoid confusion (natural or anthropogenic), and add the fraction of mass loss caused by anthropogenic forcing for last 20 years or so. [Nicole Wilke, Germany]	Rejected. The attribution assessment is time limited to the more recent period. Splitting across HS.1 and HS.2 should help to clarify here
111107	13	29			1850 was the end of a time of extreme advance - refer to this for balance? .. Since the end of the little ice age glacier advance in 1850? [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Content spread across HS1 and HS2 and this now should be clearer. Chapter 2 does not support a contention that the advance was extreme in nature until 1850
129951	13	30	13	30	Explanation for how "Glaciers likely contributed 25..." Is it due to melt, mass loss, retreat? [Trigg Talley, United States of America]	Taken into account. Text substantively redrafted for clarity and numbers no longer present.
93743	13	30	13	31	I was not able to track back the two mentioned figures in the sections mentioned for this statement, could you check that both the figures and the references are correct? Also, would it be possible to give only one figure that would cover the whole timeframe (1971-2018 instead of 1971-2016 and 1993-2018)? [Quentin Lejeune, Germany]	Taken into account. Text completely redrafted and numbers have been replaced. Citations carefully checked and verified
64791	13	31	13	31	The use of "last decades of the 20th century" seems disjointed and vague as all other passages on the page are more prescriptive with the use of phrases such as, "between 1993 and 2018," since the early 1990s," or "since 1950." If feasible, recommend rephrasing for consistency to something similar to "Since the 1980s." Otherwise, what the "last decades of the 20th century" represent may be ambiguous to a reader. [Casey Kopcho, United States of America]	Taken into account. Splitting content across HS1 and HS2 should have resolved this ambiguity
31587	13	31	13	31	"1993-2018": For consistency with ice-sheet paragraph (B.4.1) it would be helpful to have the value for 1992-2018 [Jean-Baptiste SALLEE, France]	Taken into account. In redrafting the GMSL has been separated and there is now no longer this period conflict.
25837	13	31	13	31	We would like to know whether the source of the figure 17+-7 mm is chapter 9, page 83, table 9.4 [Don Alfonso Pino Maeso, Spain]	No longer applicable. Numbers removed.
37487	13	31	13	32	This sentence is a blatant assertion. Changes in cloud cover, wind patterns, ocean temperatures and subsea geothermal warming of various types can account for these. (And note that the various ocean oscillations can cause changes in wind patterns and ocean temperatures.) [John McLean, Australia]	Rejected. The statement is firmly grounded in the underlying assessment and the literature.
42219	13	31	13	32	B4.2: Last sentence (L31-32) good angle and clear message. [Tina Christensen, Denmark]	Noted
54637	13	32	13	32	Does the phrase "cannot be explained without human-induced warming" mean something different than "human influence has contributed to"? If not, then recommend using consistent phrasing in the SPM to avoid confusion. [Nancy Hamzawi, Canada]	Taken into account. In redrafting efforts have been made here and elsewhere to use consistent language around attribution to avoid the potential for confusion
37493	13	32	13	32	Section 9.5 does not support your claim. That chapter ... "assesses past and possible future changes in the ocean, cryosphere and sea-level at the process-level using paleo-reconstructions, modern observations and model projections" and none of this amounts to evidence of any sort, let alone evidence to support your statement. [John McLean, Australia]	Rejected. The trace for this statement is chapter 3 and it is firmly grounded in the literature
100229	13	34	13	34	Re-write for clarity: During the last decade, Arctic summer sea-ice area was at its lowest since at least 1850 [Carlye Peterson, United States of America]	Accepted, changed
27857	13	34	13	34	Quantification is needed here, so that readers who have not read the SROCC understand the amplitude of the decline. [Eric Brun, France]	See 111645

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111645	13	34	13	36	The loss of summer Arctic sea ice over recent decades is one of the most visible and dramatic changes in the climate system. I suggest it is worth putting a number in here to illustrate the size of it. Also suggest refer to Fig. SPM.7. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints preclude such an addition
37489	13	34	13	36	Remove this speculation and wild assertion. No-one knows the true extent of the sea ice area (by which I assume more than 10% of an area contained sea ice) until satellite based observations began in the 1970's. Prior to that year observations were at ground-level and obviously limited in what could be seen. Further, 1850 was when Europe started emerging from the Little Ice Age, which logically would involve warming and a reduction in sea ice. [John McLean, Australia]	Rejected. This statement is firmly grounded in the assessment undertaken in chapter 2
25839	13	34	13	36	It could be added to this sentence that Arctic Sea Ice Area has also decreased in winter, as stated in chapter 2, page 58, lines 17-18 : "In summary, since the late 1970s, Arctic SIA has decreased both in summer and winter (very high confidence)" [Don Alfonso Pino Maeso, Spain]	Taken into account. The redrafted HS2.3 draws a distinction now between summer and annual retreat.
15437	13	34	13	38	The decreasing trend of September Arctic sea-ice area is very significant: -74,000 km ² yr ⁻¹ (-15% relative to the 1981-2010 mean) (Ch.2, P.57, lines 8-10). Also, multiyear ice has nearly disappeared in 2018 (Ch.2, P.57, line 34-35). It is suggested to reflect these significant changes in the Arctic in the Summary for Policymakers. [SAI MING LEE, China]	See 111645
38923	13	35	13	35	What caused the other half? If the data only allows for a statement about half of the reduction, I would say so to limit options for misinterpretations. [Maike Nicolai, Germany]	Taken into account. Text reformulated for clarity and the use of the term at least half deprecated
39533	13	36	13	37	There is no clear evidence that the largest glacier of the world, Antarctica, experienced mass loss within uncertainties. In addition, the sea ice around it showed an increase of 11,300 km ² per year (www.pnas.org/cgi/doi/10.1073/pnas.1906556116) [François Gervais, France]	Rejected. Antarctica is an ice sheet not a glacier and is assessed accordingly. Additionally, the paper mentioned actually reports a decrease of Antarctic sea ice after 2014, this is consistent with our assessment that 'Antarctic sea-ice area has experienced no significant overall change since 1979'.
81417	13	36			Sea ice thickness has also declined in the Arctic at least and should also be mentioned. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints preclude such an addition
111647	13	36			I wasn't sure what was meant by 'current Arctic sea-ice loss'. Rate? Amount? Suggest clarify. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text reformulated and hopefully now clearer
11587	13	37	13	37	Need a confidence statement here [Gerhard Krinner, France]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
129953	13	37	13	37	[CONFIDENCE] Are the authors referring to a statement of medium confidence in Chapter 9? If so, suggest changing 1000 to 1450. Chapter 9, page 42, states "but as in AR5 and SROCC, there remains medium confidence that the current pan-Arctic sea-ice loss is unique during the past 1450 years." In addition, the authors could focus in on September sea ice concentrations similar to the SPM for the SROCC where it states: "These sea ice changes in September are likely unprecedented for at least 1000 years." [Trigg Talley, United States of America]	Taken into account. The trace for this statement is to the primary assessment undertaken in chapter 2. The discrepancy with chapter 9 has been resolved in the underlying report.
81893	13	37	13	37	There is no significant trend in Antarctic sea ice over the 1979-2018 period, but significant trends over the 1979-2015 and dramatic decrease over 2016-2018 period. Would think this is worth mentioning [Dan Zwartz, New Zealand]	See 15037

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69361	13	37	13	37	The bullets from B.4.1 to 4.5 are mostly about passive impacts of climate change on the cryosphere. Therefore, in B.4.3 it would seem fair to mention about the active role that the cryosphere is playing in climate change. A formulation such as "The sea ice decrease is also affecting the carbon uptake in this region." could be inserted after "1000 years". [Kaoru Magosaki, Japan]	Rejected. Insufficient basis exists in the long report to justify such an insertion.
25841	13	37	13	37	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
83357	13	37	13	38	It is important to change "There is no significant trend in Antarctic sea-ice area for the period 1979 to 2018" to "There is no significant trend in overall circum-Antarctic sea-ice area for the period 1979 to 2018 (high confidence), but there is high confidence that this overall pattern is made up of strong and contrasting regional and seasonal contributions and contrasting regional trends in annual sea ice-season duration. There is high confidence that overall Antarctic sea-ice area has dipped top record lows since 2016, after attaining recird highs in 2012-2014. There are insufficient data to determine whether Antarctic sea ice thickness has changed." These are important additional facets of observed change and variability in Antarctic sea ice coverage, that set it well and truly alongside Arctic sea ice (in its different geographical setting. In fact, Parkinson (2019) states that the rate of Antarctic sea ice decrease since 2016 is greater than that in the Arctic. [Robert Massom, Australia]	Rejected. This request for substantial detail is at odds with the request from governments for a short and concise SPM. This detail is available in the TS and in particular in the underlying report.
15037	13	37	13	38	Add a sentence explaining 'no significant trend in the Antarctic', as on the face of it this may seem surprising. References to 2.3, 3.4, and 9.3 are insufficient and should be unnecessary with a clear summary. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints preclude such an addition
107985	13	37	13	38	No comment is made about whether we understand the reason for no significant trend in Antarctic sea-ice area, and this would make the assessment stronger (e.g. is lack of trend inconsistent or consistent with model simulations?). [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	See 15037
42653	13	37			Can a reason(s) be given for the different response of Arctic and Antarctic sea-ice to global warming? [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This information is assessed in the long report but cannot be included in the SPM for length reasons.
37497	13	38	13	38	Section 9.3 does not support your claim. That chapter ... "assesses past and possible future changes in the ocean, cryosphere and sea-level at the process-level using paleo-reconstructions, modern observations and model projections" and none of this amounts to evidence of any sort, let alone evidence to support your statement. [John McLean, Australia]	Rejected. Unclear what reviewer is suggesting and the assessment is firmly grounded in the underlying report.
41303	13	40	13	40	1978 seems to be a bit too precise... Would "late 1970s" work as well? [Alexander Nauels, Germany]	Taken into account. The revised version broadens this statement to more observed snow trends since the 1950s.
27859	13	40	13	40	What is the amplitude of this decline? [Eric Brun, France]	Noted. Not applicable. The revised version only assesses the attribution aspect.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129955	13	40	13	41	The B.4.4 statement that "seasonal snowfall has been delayed" is a bit confusing (for instance, is its terminus in Spring not also accelerated to earlier dates..?). If so, then this first sentence could be revised to say: "Northern Hemisphere spring snow cover has decreased since at least 1978 (very high confidence), and the period of seasonal snowfall has been constricted." [Trigg Talley, United States of America]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
129957	13	40	13	41	Is this statement accurate"seasonal snowfall has been delayed"? Northern Hemisphere fall snow cover is in a clear upward trend. [Trigg Talley, United States of America]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
4553	13	40	13	41	This is cherry picking. Northern Hemisphere snow cover has been increasing during autumn and winter during the same time interval. You are just mentioning the reduction in spring. What is the motivation of the authors to do so and select just the trends that may match their personal preferences in terms of „narrative structure and storylines“? [Sebastian Luening, Switzerland]	Noted. As assessed in section 9.5, only one dataset among several suggests an increase in autumn snow cover, and it is physically inconsistent with other trends (in particular temperature). This casts doubt on these reconstructions. Mentioning these inconsistent observations in the SPM is therefore not warranted.
107987	13	40	13	41	NH spring cover is reported, but why is this more important than other seasons? Could the reason for this selection be made clear. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Due to space constraints, this cannot be fully explained in the SPM, unfortunately. The reason is that spring snow cover is most tightly linked to temperature changes, much more than autumn snow cover. This is explained in section 9.5.
38925	13	40	13	46	I would cut this paragraph into two and dedicate one to snow and one to permafrost. [Maike Nicolai, Germany]	Not applicable. The revised version contains no explicit mention of observed permafrost changes due to space constraints.
50201	13	40	13	46	If this trend (in NH spring snow cover) extends back to the 1920s, but anthropogenic influence can only be identified back to the 1950s, it would be helpful to indicate what the cause of change was in the 1920-1950 region e.g. natural variability, or if also human influence but issue is lack of obs could 'back to at least the 1950s' be added? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Due to space constraints, the revised version does not mention the snow trends since the 1920, only the attributable trends since the 1950s
50215	13	40	13	46	A separation of seasonal snow cover and permafrost (currently both in B4.4) would avoid confusion for the reader. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised version does not mention observed permafrost trends, limiting the potential for confusion.
87175	13	40	13	46	We are surprised and somewhat disappointed to see such little mention of permafrost in the SPM, with only two sentences devoted to it here. We would like to see more attention devoted to this issue. [Oyvind Christophersen, Norway]	Noted. Unfortunately, there are obvious space constraints. The revised version mentions permafrost 6 times in the context of projected future changes.
34983	13	40	13	46	The SOD claims a reduction in NH snow cover since 1978, with an anthropogenic influence since the 1950s. Please see rebuttal comment #11 above. [Jim O'Brien, Ireland]	Noted. The two different dates were indeed confusing, as they did not refer to exactly the same type of observations. The text was simplified to reduce the potential for confusion among non-specialist readers. The assessment of the anthropogenic influence on observed snow cover trends since 1950 is fully backed up by the detailed material presented in sections 2.3 and 9.5 of the full report.
9727	13	40	13	46	this could give rise to the question: So was there anthropogenic influence between 1920 and 1950 or did that just intensify a trend already underway and nothing to do with human activity [Jonathan Lynn, Switzerland]	Taken into account: This statement was streamlined on now only assesses attribution of snow cover trends since 1950.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
67645	13	41	13	41	I'm not sure a policy maker will understand "delayed", nor do I. Is it starting later and ending later, or shortened? [Karen Rosenlof, United States of America]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
11589	13	41	13	41	"and seasonal snowfall has been delayed" - lacks clarity, could be snowfall cessation in spring... [Gerhard Krinner, France]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
54639	13	41	13	41	Not clear what is meant by the phrase 'seasonal snowfall has been delayed'. Does this mean a reduction in snow cover duration due to later snow onset? [Nancy Hamzawi, Canada]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
130451	13	41	13	41	Statment on "The currently observed Arctic amplification is caused in part by surface albedo changes due to losses of snow cover and sea ice' is not consistent with TS and that in the underline chapter (Line 45, Ch7) as "Feedbacks associated with the loss of sea ice and snow are central to polar amplification'. [Panmao Zhai, China]	Comment misplaced. Comment refers instead to B4.5. This passage of text has been removed in redrafting to create a shorter SPM
129959	13	41	13	41	The meaning of "delayed" is unclear in this context. [Trigg Talley, United States of America]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
104117	13	41	13	41	Is the *onset* of snowfall delayed, or also the end of the snowy period? [Philippe Tulkens, Belgium]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
8123	13	41	13	41	Is the *onset* of snowfall delayed, or also the end of the snowy period? [Frank Dentener, Italy]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
27861	13	41	13	41	The term "seasonal snowfall has been delayed" is ambiguous for policymakers and should be clarified. Does it mean: - that the first snowfalls in Fall or Winter occur later than in the past? - that the snowfall season itself is delayed, suggesting that the last snowfalls in Spring occur later, which is unlikely? - that the snowfall season is shorter that in the past (starts later and ends earlier)? [Eric Brun, France]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
44735	13	41	13	42	"medium confidence... very likely... contributed" is vague. Could this be expressed in more substantive terms? [Markku Rummukainen, Sweden]	Noted. The revised statement only refers to the attribution of observed snow cover trends since the 1950s - this should reduce potential for confusion and thus perceived vagueness. However, the observed trends are geographically rather complex, which is why the detailed assessment has to remain in the underlying chapters.
42221	13	41	13	43	B4.4: (L41-43) Unclear joint sentence with the trend and attribution having different intervals. We suggest leaving out the first statement "There is medium confidence that this trend extends back to the 1920s" [Tina Christensen, Denmark]	Taken into account. Statement shortened as suggested.
36127	13	41			snow cover is obvious, but a "delay" in seasonal snowfall is not. Is mid-winter snowfall delayed? I don't remember this quantity in previous AR, so explain. ?Delay in fall-winter snow? [Michael PRATHER, United States of America]	Taken into account. Indeed, "delayed" was unclear. Due to space constraints, the revised version makes no statement on snowfall timing.
37491	13	43	13	43	Your claim that anthropogenic influences have contributed is merely an assertion for which you have no evidence. [John McLean, Australia]	Noted. The evidence is provided through references to the scientific literature that leads to this assessment in sections 2.3 and 9.5 of the underlying report.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44737	13	43	13	43	How large are the losses? [Markku Rummukainen , Sweden]	Not applicable. Due to tight space constraints, observed permafrost thaw is not specifically mentioned in the revised version.
27863	13	43	13	43	The word "lost" here is inappropriate: it has decreased. Arctic and mountain permafrost has been lost should be replaced by: "Arctic and mountain permafrost thaw is observed over recent decades". [Eric Brun, France]	Noted. Due to tight space constraints, observed permafrost thaw is not specifically mentioned in the revised version.
84707	13	43	13	44	better to include years' interval for "recent decades" and for "last decade" [Annalisa Cherchi, Italy]	Not applicable. Due to tight space constraints, observed permafrost thaw is not specifically mentioned in the revised version.
4555	13	43	13	46	You need to mention that you are always comparing to the Little Ice Age, the coldest period of earth history of the past 10,000 years. A better comparison would be for an ice/snow/permafrost condition averaged over the past 10,000 years, including the very warm Holocene Thermal Maximum when the Greenland ice sheet was smaller than today. [Sebastian Luening, Switzerland]	Noted and not applicable. The Holocene thermal maximum would certainly not be a good reference, as it is well known that reduced NH cryosphere extents and masses during this period were caused by stronger summer insolation due to orbital changes. Moreover, the revised version does not discuss observed and reconstructed permafrost changes.
25843	13	43	13	46	It would more helpful if the references to "recent decades" and "past three to four decades" are specified indicating the starting and ending years. [Don Alfonso Pino Maeso, Spain]	Not applicable. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.
88445	13	44	13	44	last decade refers to 2007-2016 (Biskaborn et al. 2019) - revise to be clear about the time period given it is not the last decade. It might be better to mention the longer term trend first to provide context for this decadal trend so that it is clear this is part of a longer term trend. [Sharon Smith, Canada]	Not applicable. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.
25847	13	44	13	44	Please consider replacing "last decade" for "2007-2016" as stated in chapter 9, page 75, lines 18-20: "Between 2007 and 2016, the global permafrost temperature has increased at $0.29 \pm 0.12^{\circ}\text{C}$ near the depth of zero annual amplitude (medium confidence)" [Don Alfonso Pino Maeso, Spain]	Not applicable. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.
36129	13	44			In context, what do we make of 0.3C warming of permafrost? do we compare it with GSAT? what has happened to SAT over the permafrost? [Michael PRATHER, United States of America]	Not applicable. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.
44739	13	45	13	45	The previous sentence talks about global losses, so perhaps, "In the Arctic, there are widespread...", although it still is not clear what the difference is from the previous sentence. [Markku Rummukainen , Sweden]	Noted. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.
81831	13	45	13	46	Check that "30m" is correct. Suspect it should be "3m" . Can't find a reference to 30m in the line of sight {chapter sections} [Dan Zwartz, New Zealand]	Noted. Due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version. Some boreholes do provide evidence down to 30 m.
104119	13	45	13	46	Can numbers be provided for the permafrost melting? How much is melted or about to be melting? [Philippe Tulkens, Belgium]	Noted. Due to tight space constraints, observed permafrost thaw is not specifically mentioned in the revised version.
8125	13	45	13	46	Can numbers be provided for the permafrost melting? How much is melted or about to be melting? [Frank Dentener, Italy]	Noted. Due to tight space constraints, observed permafrost thaw is not specifically mentioned in the revised version.
37499	13	46	13	46	Section 9.5 does not support your claim. That chapter ... "assesses past and possible future changes in the ocean, cryosphere and sea-level at the process-level using paleo-reconstructions, modern observations and model projections" and none of this amounts to evidence of any sort, let alone evidence to support your statement. [John McLean, Australia]	Noted. Not clear what point the reviewer tries to make. The statement referred in particular to a paper by Biskaborn et al in Nature Communications, duly cited in chapters 2 and 9. However, due to tight space constraints, observed permafrost thaw and warming is not specifically mentioned in the revised version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
31597	13	48	13	48	long term should be clarified (multi-century?). Also it would probably be wise to mention that Antarctic amplification has not yet been observed in the modern historical record [Jean-Baptiste SALLEE, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
71331	13	48	13	49	I suggest rewording these two lines as: "Stronger surface warming at the poles and at low latitudes is a robust feature of the projected long-term response to greenhouse gas forcing in both hemispheres, and of observed climate changes in the northern hemisphere (...". Reason: The implication in the current text that this is also a feature of observed climate change in southern polar latitudes seems inconsistent with the text of lines 5-6 of page SPM-27 which places the expected time of emergence of Antarctic amplification somewhere in the future, and also seems inconsistent with Figure SPM-5 [David Wratt, New Zealand]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
35267	13	48	13	49	This is true for the North Pole, but not the South Pole, where there has been little observed change and models project relatively little (because it's in the middle of a, depending upon season, 1000mi diameter circle of ice. You should change the text and emphasize the NP. [patrick Michaels, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
37501	13	48	13	50	Stronger surface warming at the poles is consistent with greater temperature variability at the poles, see section 2.8 of McLean (2018) "An Audit of the Creation and Content of the HadCRUT4 Temperature Dataset" where it is shown that standard deviations associated with monthly mean temperatures are inversely proportional to those mean temperatures. The cause of the larger standard deviations at the poles is very likely to be variations in wind patterns, which are much greater than the variations in tropical regions for example. [John McLean, Australia]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
65553	13	48	13	51	Suggest revising this passage to better reflect the nuance in data. Currently the text implies more uniformity of warming in the Antarctic than the data warrant. The main warming signal is in West Antarctica and the Antarctic Peninsula. Other parts of Antarctica, including the Southern Ocean show far more heterogeneity and even cooling trends (e.g. Jones et al, Nature Climate Change 2016). The text should reflect this nuance. Indeed text on Page 27, Lines 4-5 expresses confidence that Antarctic amplification "will" emerge, implying that it has not yet emerged. [Kushla Munro, Australia]	Not applicable. Passage removed in interests of creating a shorter and more concise SPM.
65069	13	48	13	51	The causes of the stronger surface warming at high latitudes in the southern hemisphere could be shortly discussed here as albedo changes as in the Northern Hemisphere not obviously plays the same role in the Southern Hemisphere [Magnus Joelsson, Sweden]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
86957	13	48	13	51	The reason for albedo decrease should be added here e.g from text in ch 6 page 42, line 47 stating that there is high confidence that darkening of snow by deposition of BC and other light-absorbing aerosol species increases the rate of snow melt (Hock et al., 2019 Section 2.2.2; and Meredith et al., 2019 3.4.1.1.3). Further we advice to use albedo decrease instead of albedo changes, since we anticipate that this is what is meant. [Oyvind Christophersen, Norway]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
4557	13	48	13	51	Polar amplification is a phenomenon that is also compatible with natural climate change. It has been observed for many pre-industrial warm phases of the past 10,000 years. It surely is not a "fingerprint" for the effect of greenhouse gases. [Sebastian Luening, Switzerland]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
117219	13	48	13	51	It is not clear if polar amplification is observed for both poles or only Artic. [Maisa Rojas, Chile]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42223	13	48	13	51	B4.5: Please quantifiy the level of Arctic amplification (e.g. "more than twice" or similar) [Tina Christensen, Denmark]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
97269	13	48	13	51	The second most process causing arctic amplification should also be mentioned here please. [Nicole Wilke, Germany]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
40369	13	48	14	14	I couldn't find a mention of the effects of Arctic amplification on mid-latitude weather (Cross-Chapter Box 10.1) in the SPM, which has been much discussed in the media since AR5. As noted in Ch11 "There is also low confidence in possible effects of the Arctic warming on mid-latitude temperature extremes". Although this is a low confidence statement, it's important to include in the SPM as it opposes the 'high confidence' statements coming out in the media. [TSU WGI, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
132615	13	49	13	49	Stonger surface warming of Antarctica than the tropics has not yet emerged in observations, as can be seen in Figure SPM.5. We should should make sure this language is consistent with the assessment in the Chapters. [Kyle Armour, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
38927	13	50	13	50	Readers of the SPM might not know what the "Arctic amplification" is. Could this be explained very briefly in general terms, for example "an increase in Arctic temperatures that is twice as fast as in the mid-latitudes"? [Maike Nicolai, Germany]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
25845	13	50	13	50	It would be useful to explain the concept of "Arctic amplification" the first time it appears in the text. [Don Alfonso Pino Maeso, Spain]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
104121	13	50	30	51	How much is due to albedo effect? Which part? [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
8127	13	50	30	51	How much is due to albedo effect? Which part? [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
50209	13	51	13	51	The currently observed Arctic amplification is caused in part by surface albedo changes due to losses of snow cover and sea ice.snow cover (on land) and sea ice' - Greenland's accelerated warming is also partly due to the elevation dropping as top layers of ice are melting and exposure to warmer air at lower altitude. Suggest it would be useful to mention here for completeness. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
11591	13	51	13	51	" is caused in part by... " Bit vague. Confidence statement lacking. [Gerhard Krinner, France]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
4093	13	51	13	51	{7.4, cross-chapter Box 10.1} [Daoyi Gong, China]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
34521	14	1	14	1	Chapter 2 presents observed changes in the atmosphere, ocean, cryosphere, and biosphere, but the SPM omits discussion of the biosphere, which I would have expected to appear at this point in the document. [Russell Vose, United States of America]	Noted. Revised section HS1.8 refers to biosphere
34523	14	1	14	1	Table SPM.1 is an excellent summary of trends for extremes. Could something comparable be done for other observed changes in the atmosphere, ocean, cryosphere, and biosphere? [Russell Vose, United States of America]	Noted but this table was removed from the revised version

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41813	14	1	14	3	I would indicate here that the driver of this drought decrease is the enhanced atmospheric evaporative demand/atmospheric dryness [Sergio Vicente-Serrano, Spain]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to 4 increases in atmospheric evaporative demand (medium confidence)."
31557	14	2	14	2	MHW and sea-level extremes are missing (except in the chapeau for MHW). I think Marine extreme should be dedicated a paragraph at least [Jean-Baptiste SALLEE, France]	Accepted. Section HS3.1 discusses marine heatwaves
90761	14	2	14	2	Write: "B.5 Climatic extremes" to use the same wording as in the glossary. Moreover, this terminology is not unambiguous since the Glossary defines "Climatic Extreme (extreme weather or climate event)", allowing for the mixing of weather extremes with climate extremes. The use of this "extreme" jargon in Section B.5 of the SPM is certainly not going to help a better understanding of the messages of the SPM by policymakers and the general public. [José Romero, Switzerland]	Noted. We use "extremes" since we discuss not only climate extremes but also weather extremes
66523	14	2	14	2	A general comment on Section C: Assessment of implications for impacts (from CH12) are not covered enough in this section, due to lack of time. Fire weather, heat stress, and other CIDs such as snow conditions snow for winter tourism, energy demand or renewable energy (wind, solar) etc could be added, with inputs from Ch12. Results from other CIDs than classical extremes; these could be added as complement to existing statements along section C [robert vautard, France]	Noted. Section HS3.5 discusses fire weather and compound flooding
87177	14	2	15	13	There seems to be new information in at least chapter 12 regarding lightning and climate change. Please consider to include more information in the SPM on lightning. This is very relevant for wildfires and for the security of the electricity grids and telecommunication. [Oyvind Christophersen, Norway]	Noted. However, we discuss the topics where we have higher confidence.
104123	14	2	15	13	Two more paragraphs should be added in section B5 in order to provide the findings about 1. forest fires and 2 oceans-related extreme (heatwave, storms) [Philippe Tulkens, Belgium]	Noted. Revised section HS3.1 discusses marine heatwaves. Section HS3.5 discusses fire weather
37503	14	2	18	3	Section 11.2 shows all this talk of "extremes" to be based on very subjective judgment as to what "extreme" actually means. The SPM makes many assertions about extremes but no fails to provide any definition of what an "extreme" condition is. There is also a failure to acknowledge that such events might have occurred in the past (e.g. 30 or more years ago) but went unremarked because they were simply regarded as the vagaries of weather. [John McLean, Australia]	Noted. We discuss changes in extremes during the recent past (see section HS3 in the revised SPM)
131705	14	2			suggest using climate extremes to align with the glossary [Hans Poertner and WGII TSU, Germany]	Noted. We use "extremes" since we discuss not only climate extremes but also weather extremes
81505	14	4	14	4	Recommend to elaborate further on the aspect of 'virtually' or replaced with another term which deemed appropriate. [Ee Ling Lee, Malaysia]	Rejected. "Virtually certain" is part of the IPCC confidence language.
110801	14	4	14	4	*****Very good idea to add this chapter Extremes [cathy clerbaux, France]	Noted. Thanks
97271	14	4	14	4	The statement "Changes in extremes are widespread since the 1950s" is somewhat misleading because of the implicit message that changes in extremes were less widespread before the 1950ies. The information in footnote 8 (no available data before 1950) is important and should be included in the main text. [Nicole Wilke, Germany]	Noted. Section HS3.2 mentions "good observational coverage". Section HS3 does not mention "widespread".
34525	14	4	14	5	The phrase "extreme air temperature" is ambiguous. It could be extremes lows as well as extreme highs. I know it's the latter, but it's probably better to "extreme high temperatures" instead. [Russell Vose, United States of America]	Noted. Revised SPM uses "hot extremes"

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23387	14	4	14	13	Box SPM.3 should also be cited here. [Anna Amelia Sörensson, Argentina]	Noted. This boxed was removed from the revised SPM
86959	14	4	14	13	Please consider to shorten this highlighted conclusion. We find it difficult proposing a sentence for deletion, but since there is only one with medium confidence that could be one criteria for you to consider. Wildfires could also maybe be interpreted as an impact on natural systems and therefore could be treated more appropriately under the WGII Assessment Report. [Oyvind Christophersen, Norway]	Noted. HS3 was summarized: "Climate change is already affecting every region across the globe, with human influence contributing to many observed changes in extremes and other climatic impact-drivers". HS3 bullets discuss the different aspects
90183	14	4	14	14	The first and last sentence of this headline message seem to convey the main messages : "Changes in extremes are widespread since the 1950s, including a virtually certain increase in extreme air temperature and marine heatwaves (high confidence), intensification in extreme precipitation (high confidence), and increase in drought potential in the dry season when aggregated on the global scale (high confidence)." and "It is extremely likely that human influence is the main contributor to the observed increase in the likelihood and severity of hot extremes, including marine heatwaves, and the observed decrease in the likelihood and severity of cold extremes." [Georges Gehl, Luxembourg]	Noted. HS3 was summarized: "Climate change is already affecting every region across the globe, with human influence contributing to many observed changes in extremes and other climatic impact-drivers". HS3 bullets discuss the different aspects
104125	14	4	14	14	Information on continental heatwaves needs to be provided as well, even if it will more scattered than marine heatwaves. It is not very clear what is meant with drought potential, and what information is given by the aggregation on the global scale. [Philippe Tulkens, Belgium]	Noted. Section HS3.1 discusses land heatwaves
8129	14	4	14	14	Information on continental heatwaves needs to be provided as well, even if it will more scattered than marine heatwaves. It is not very clear what is meant with drought potential, and what information is given by the aggregation on the global scale. [Frank Dentener, Italy]	Noted. Section HS3.1 discusses land heatwaves
34985	14	4	15	13	The SOD claims that changes in weather extremes are widespread since the 1950s. Please see rebuttal comment #12 above. [Jim O'Brien, Ireland]	Noted but we cannot identify what comment #12 refers to.
129961	14	4	22	25	Weather extremes -- storms, heat, drought, wildfire, etc. -- pose threats to U.S. national security by harming defense installations and reducing military readiness. Extreme weather also threatens stability in areas of the world of strategic interest to the U.S., acting as a "threat multiplier" that will impact other threats to national security, driving global instability. Such instability is a threat to U.S. national security interests. Citation: https://gja.georgetown.edu/2020/03/18/preparing-for-the-inevitable-climate-change-and-the-military/ [Trigg Talley, United States of America]	Noted. This SPM corresponds to WGI. Impacts like those mentioned by the reviewer are evaluated by WGII
44741	14	5	14	7	Why is the reference to "globally aggregated"? One would expect that the changes are larger in some regions than others. [Markku Rummukainen, Sweden]	Noted. This text has been removed from the revised SPM
4559	14	5	14	40	Extreme precipitation has not become more common. Sun, F., Roderick, M. L., Farquhar, G. D. (2012): Changes in the variability of global land precipitation: Geophys. Res. Lett. 39 (19), L19402. [Sebastian Luening, Switzerland]	Noted. Revised section HS3.2 now states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), , and human influence is likely the main driver."
23379	14	6	14	6	I was confused by the term "drought potential" since it sounds like it could be a well defined concept, an index for example, I looked through the cites chapters and did not find "drought potential", so, I guess it just means "chance that drought occur"? Suggest to change to something less confusing (appears in a few more places in the SPM). [Anna Amelia Sörensson, Argentina]	Noted. This text has been removed from the revised SPM
129965	14	6	14	6	What about an increase in drought potential that can last over multiple "dry seasons" or multiple years? [Trigg Talley, United States of America]	Noted. This text has been removed from the revised SPM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27865	14	6	14	6	Please add the definition of 'drought potential' in the glossary, and explain what it is here. [Eric Brun, France]	Noted. This text has been removed from the revised SPM
25849	14	6	14	6	It would be useful to explain the concept of "drought potential" the first time it appears in the text. [Don Alfonso Pino Maeso, Spain]	Noted. This text has been removed from the revised SPM
129963	14	6			[DROUGHT] "Drought potential" is a non-standard phrase. It isn't even clear what physical concept is being alluded to with such usage. At minimum, define "drought potential" and discuss the concept in Box SPM.1. Or, better yet, speak about "drought" directly. The statement itself for an "increase in drought potential potential in the dry season when aggregated on the global scale" is convoluted and needs to be rewritten/simplified. [Trigg Talley, United States of America]	Noted. This text has been removed from the revised SPM
89823	14	6			"drought potential" needs to be defined, perhaps in a footnote [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This text has been removed from the revised SPM
87331	14	7	14	7	Insert: It is likely that anthropogenic influence is the main cause of the observed intensification of heavy precipitation in land regions. [Marcel Berk, Netherlands]	Noted. Revised section HS3.2 now states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), , and human influence is likely the main driver."
40839	14	7	14	9	SPM <-> TS: The TS (4.3.2) mention of arid areas is a bit broader: There is medium to high confidence in an expansion of arid areas towards the midlatitudes, and in pronounced drying in the Mediterranean, southern Australia, southern North America, Central America and northeastern Brazil. {8.4.1} Any reason for limiting the SPM to majority developing country mentions? [TSU WGI, France]	Noted. This text has been removed from the revised headline statement
40841	14	7	14	9	SPM <-> TS: There were a number of consistency issues SPM <-> TS . My other sheet has more details : Here is one the TS (4.3.2) mention of arid areas is a bit broader: There is medium to high confidence in an expansion of arid areas towards the midlatitudes, and in pronounced drying in the Mediterranean, southern Australia, southern North America, Central America and northeastern Brazil. {8.4.1} Any reason for limiting the SPM to majority developing country mentions? [TSU WGI, France]	Noted. This text has been removed from the revised headline statement
129967	14	8	14	8	With regard to "...wildfires have become more intense in some fire-prone regions...", the word 'intense' is not really correct. Fire intensity refers to the physical heat output of combustion, whereas the documented trend is in fire severity, which is the ecological impact of combustion on vegetation and soils. Annual area burned in wildfires is also increasing. See: Kitzberger T, DA Falk, AL Westerling, and TW Swetnam. 2017. Direct and indirect climate controls predict heterogeneous early-mid 21st century wildfire burned area across western and boreal North America. PLoS One 12(12): e0188486. https://doi.org/10.1371/journal.pone.0188486 [Trigg Talley, United States of America]	Noted. We do not mention wildfires in the revised SPM. We now focus on fire weather. Section HS3.5 states: "The probability of compound events has likely increased since 1950. This includes increases in the frequency of concurrent heatwaves and droughts (high confidence), fire weather in the Mediterranean region, northern Eurasia, the United States, and Australia (medium confidence), and compound flooding (high confidence). The land area affected by concurrent extremes has increased (high confidence)."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27867	14	8	14	9	Wildfires are mentioned here in the summary, but then are not dealt with in the text, with just a short mention in the last line of table SPM.1. [Eric Brun, France]	Noted. We do not mention wildfires in the revised SPM. We now focus on fire weather. Section HS3.5 states: "The probability of compound events has likely increased since 1950. This includes increases in the frequency of concurrent heatwaves and droughts (high confidence), fire weather in the Mediterranean region, northern Eurasia, the United States, and Australia (medium confidence), and compound flooding (high confidence). The land area affected by concurrent extremes has increased (high confidence)."
34987	14	8	14	12	The SOD claims that wildfires have become more intense in the Mediterranean Region, SW USA and Australia. Please see rebuttal comment #12 above. [Jim O'Brien, Ireland]	Noted but we cannot identify what comment #12 refers to.
24109	14	8	14	13	The SPM and the underlying chapter 11 appears to lack a thorough assessment of the attribution of TCs to anthropogenic and natural factors. This seems to be an oversight that needs to be remedied. There is some material in the table on Page SPM-16 but this does not seem to be well supported by material in chapter 11. [Peter Stott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section HS3.4 discusses tropical cyclones.
50221	14	8	14	13	The SPM and the underlying chapter 11 appears to lack a thorough assessment of the attribution of Tropical Cyclones to anthropogenic and natural factors. This seems to be an oversight that we suggest is remedied. There is some relevant material in the table on SPM page 16 but this does not seem to be well supported by material in chapter 11. Please could you ensure this is consistent across the report. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section HS3.4 discusses tropical cyclones.
81419	14	8			Suggest adding the sentence at SPM-15 lines 8-9, referring to tropical cyclones, here to give a more rounded picture in the short version of the report. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section HS3.4 discusses tropical cyclones.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
117221	14	9	14	9	<p>there is evidence for Chile as well. Maybe change to "Med.-type climate regions" ?.</p> <p>Gómez-González S, ME González, S Paula, Díaz-Hormazábal I, A Lara, M Baquerizo-Delgado. 2019. Temperature and agriculture are largely associated with fire activity in Central Chile across different temporal periods. Forest Ecology and Management 433: 535–543.</p> <p>McWethy D. A Pauchard, R García, A Holz, ME González, TT Veblen, J Stahl, B Currey 2018. Landscape drivers of recent fire activity (2001-2017) in south-central Chile. PLoS ONE e0201195.</p> <p>González, ME., S Gómez-González, A Lara, R Garreaud, I Díaz-Hormazábal. 2018. The 2010-2015 Megadrought and its influence on the fire regime in central and south-central Chile. Ecosphere DOI:10.1002/ecs2.2300</p> <p>Urrutia- Jalabert R, ME González, A González-Reyes, A Lara, R Garreaud. 2018. Climate variability and forest fires in central and south-central Chile. Ecosphere DOI:10.1002/ecs2.2171</p> <p>González, M.E., Lara, A., Urrutia, R., J. Bosnich. 2011. Cambio climático y su impacto potencial en la ocurrencia de incendios forestales en la zona centro-sur de Chile (33º - 42º S). Bosque 32(3): 215-219.</p> <p>Bowman, D., Moreira, A., Kolden, C., Chávez, R., Muñoz, A., Salinas, F., González, A., Rocco, R., Barrera, F., Williamson, G., Borchers, N., Cifuentes, L., Abatzoglou, J. y Johnston, F. 2018. Human–environmental drivers and impacts of the globally extreme 2017 Chilean fires. Ambio, 48(1): 350–362. https://doi.org/10.1007/s13280-018-1084-1 [Maisa Rojas, Chile]</p>	Noted. We do not mention wildfires in the revised SPM. We now focus on fire weather, which is different from wildfire occurrence.
27869	14	9	14	12	This is a major conclusion of this report. It could be more enhanced. [Eric Brun, France]	Noted. Section HS3.1 focuses only on hot extremes.
129969	14	9			If the report sees fit to call out an increase in wildfire intensity in the Southwest United States, then perhaps it should also state that there has been an increase of wildfires over Alaska, as per the U.S. National Climate Assessment (https://nca2018.globalchange.gov/). [Trigg Talley, United States of America]	Noted. We do not mention wildfires in the revised SPM. We now focus on fire weather. Section HS3.5 states: "The probability of compound events has likely increased since 1950. This includes increases in the frequency of concurrent heatwaves and droughts (high confidence), fire weather in the Mediterranean region, northern Eurasia, the United States, and Australia (medium confidence), and compound flooding (high confidence). The land area affected by concurrent extremes has increased (high confidence)."
110803	14	10	14	11	two very similar sentences [cathy clerbaux, France]	Noted. HS3 was summarized: "Climate change is already affecting every region across the globe, with human influence contributing to many observed changes in extremes and other climatic impact-drivers". HS3 bullets discuss the different aspects
97273	14	10	14	11	"likelihood" of extremes should be "frequency"? [Nicole Wilke, Germany]	Accepted. This word is not used in revised section HS3. We now use frequency.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36131	14	10			avoid use of 'likelihood' here (find another word) as that is entwined in the calibration language [Michael PRATHER, United States of America]	Accepted. This word is not used in revised section HS3. We now use frequency.
27871	14	11	14	11	A footnote could explain the concept of marine heatwave. [Eric Brun, France]	Rejected. This is defined in the glossary.
77597	14	11	14	12	Could include this sentence in the opening conclusion series [Emer Griffin, Ireland]	Noted. HS3 was summarized: "Climate change is already affecting every region across the globe, with human influence contributing to many observed changes in extremes and other climatic impact-drivers". HS3 bullets discuss the different aspects
32883	14	11			Marine heatwaves are mentioned in the summary box but not in the bullet points below. Should they be? [Helene Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section HS3.1 now discusses marine heatwaves
54645	14	12	14	12	For consideration: mention increased probability of exceeding major tropical cyclone intensity in the summary box. [Nancy Hamzawi, Canada]	Noted. Section HS3.4 discusses tropical cyclones.
9497	14	12	14	13	Should reference chapter 8 if you are mentioning extreme precipitation and droughts. See section 8.3 [Joelle Joelle Gergis, Australia]	Rejected. The final version of chapter 8 does not discussed extreme precipitation.
112197	14	16	14	17	Attribution to human influence in the case of tropical cyclones. The sense conveyed here is too general. There are different aspects concerning tropical cyclones and it may not be meaningful to put these all in the same attribution bin. There is the the change in the frequency of storms, the strengthening of the highest categories, the shifts in locations of storm occurrence, and possible slowdown of storms. Attribution to human influence may not have been established as yet for all these aspects. [venkatachalam ramaswamy, United States of America]	Noted. Revised section HS3.4 now states: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human-caused increases in heavy precipitation associated with tropical cyclones"
41305	14	16	14	18	This sentence seems to be almost better suited for the headline statement. [Alexander Nauels, Germany]	Rejected. We modified the structure of this section. Section HS3.1 states: "The attribution of observed changes in extremes to human influence has substantially advanced since AR5, in particular for extreme precipitation, droughts, tropical cyclones and compound events (high confidence)." The main HS statement was summarized.
8131	14	16	14	18	In what respect it is strengthened? Statistically more robust, more regions with extremes, more studies telling the same, or more studies telling a different story? [Frank Dentener, Italy]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)."
44743	14	16	14	18	This should be moved into the headline statement, as its first sentence. [Markku Rummukainen, Sweden]	Rejected. We modified the structure of this section. Section HS3.1 states: "The attribution of observed changes in extremes to human influence has substantially advanced since AR5, in particular for extreme precipitation, droughts, tropical cyclones and compound events (high confidence)." The main HS statement was summarized.

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104389	14	16	14	22	Discussion of urbanization here is unbalanced, as development has asso dramatically increase resilience to flooding and this increased resilience counters the urbanization effect on flooding. See: USGS publication Flow Modification in the Nations's Streams and Rivers 2019 (https://doi.org/10.3133/cir1461) which reports that due to the "modification of natural flows in streams and rivers... high flows have been reduced in magnitude, are of shorter duration, are less frequent, and vary less from one year to the next than they would naturally." See also Formeta and Feyen, 2019: Empirical evidence of declining global vulnerability to climate-related hazards (https://doi.org/10.1016/j.gloenvcha.2019.05.004) which reports increasing resilience to extreme weather events with increasing development. [Hunter Cutting, United States of America]	Noted. This sentence is no longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."
78613	14	16	14	27	Section B5 is good, but I wasn't sure what para 5.1 really said. The other paragraphs all have a single key point – temperature, precip, storms... Do you really need this first paragraph? For example what does the sentence mean: “the effects of increased greenhouse gas concentrations...” – it basically says that all sorts of things make some changes bigger and some smaller – but in a complicated phrasing. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Revised section HS3.1 focuses on temperature extremes. Other extremes are discussed in the other HS3 bullets
17467	14	16	14	27	There are a lot of very different points made in this paragraph which makes it difficult to read. It doesn't flow well. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Revised section HS3.1 focuses on temperature extremes. Other extremes are discussed in the other HS3 bullets
23381	14	16	14	27	"Urbanization has exacerbated the effects of global warming in cities (high confidence) and modified precipitation patterns (medium confidence)." Please cite the Box 10.2 Urban Climate".and "Box TS.8 Urban box". [Anna Amelia Sörensson, Argentina]	This sentence is not longer in section HS3. Section HS11 states: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)." The boxes suggested are mentioned in the line of sight.
110987	14	16	14	27	This is a very dense paragraph with a lot of disconnected content (no clear transitions/unifying themes). Can this be rewritten for clarity? [Monica Dean, United States of America]	Noted. Revised section HS3.1 focuses on temperature extremes. Other extremes are discussed in the other HS3 bullets

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104127	14	16	14	27	<p>Comments on section B5.1</p> <ul style="list-style-type: none"> • This paragraph appears to focus on the relationships between land use & cover and extremes. The 1st two sentences should therefore be deleted since they duplicate the summary box. • The paragraph implies that urbanisation and agricultural expansion are the main land-related drivers of extremes. What about the contribution of forests as highlighted in SRCCL? • The paragraph as written should have a logical order: first, land-use and land-cover changes, and second, aerosols. By this logic the final sentence (irrigation & area expansion) should be placed in the middle (alongside urbanisation) – preferably accompanied by forests and other phenomena of equal importance. [Philippe Tulkens, Belgium] 	Noted. Revised section HS3.1 focuses on temperature extremes. Other extremes are discussed in the other HS3 bullets
36133	14	16			B.5.1 is fine, and points out some of the weakness in earlier SPM statements about regional being mainly internal/natural. [Michael PRATHER, United States of America]	Noted. Thanks
36135	14	16			B.5.1 and B.5.2 are too long, wordy, and convoluted, their style is clearly different from the rest of SPM. Recommend shortening. [Michael PRATHER, United States of America]	Noted. Revised sections HS3.1 and 3.2 are now more concise and focus on only one topic (temperature extremes and precipitation extremes, respectively).
78963	14	17	14	17	the word "compound" is jargon, difficult to understand by an SPM. We suggest to use simultaneous or sequential occurrence of multiple extremes. [Martine Vanderstraeten, Belgium]	Noted. This definition is given in Footnote 10 in the revised SPM
80399	14	17	14	18	Should "compound extremes" be defined in a footnote, as well as "concurrent extremes"? [Paola Arias, Colombia]	Accepted. This definition is given in Footnote 10 in the revised SPM
131707	14	17	14	18	Compound extreme is not in the glossary, suggest to add [Hans Poertner and WGII TSU, Germany]	Accepted. Added to the glossary.
129971	14	17	18	3	There are different types of compound events that cause coastal flooding. Please describe what a compound event that effects coastal flood frequency entails. [Trigg Talley, United States of America]	Noted. This definition is given in Footnote 10 in the revised SPM.
129975	14	18	14	18	Provide example for "concurrent extremes" (e.g. hot and dry). [Trigg Talley, United States of America]	Noted. This definition is given in Footnote 10 in the revised SPM.
8133	14	18	14	18	How much more land is affect, and what is the uncertainty? [Frank Dentener, Italy]	Noted. Section HS3.5 now states: "The land area affected by concurrent extremes has increased (high confidence)."
25851	14	18	14	18	It would be useful to include the timeframe for the increase in the land area affected by concurrent extremes. [Don Alfonso Pino Maeso, Spain]	Noted. Section HS3.5 now states: "The probability of compound events has likely increased since 1950."
26025	14	18	14	21	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
129973	14	18	14	22	Reorder sentences (to improve the continuity of thoughts) as follows: Place the sentence beginning "Urbanization has exacerbated..." immediately before the sentence beginning "The effects of increased greenhouse..." [Trigg Talley, United States of America]	Noted. This sentence is no longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."
86961	14	18	14	26	This paragraph seems one of the few paragraphs in the SPM that brings in perspectives from the SRCCL and the living world domain. Please consider expanding to supplement the perspectives on large scale changes that currently dominate the SPM, or at least expand such perspectives in the Technical Summary. [Oyvind Christophersen, Norway]	Noted but the revised SPM does not longer mention any Special Report
8135	14	19	14	19	Do the authors mean effect of Well Mixed GHGs? [Frank Dentener, Italy]	Noted but this sentence was removed from the revised SPM
44745	14	19	14	27	Suggest rearranging so that this text is made into a last sub-bullet of B5. I.e. placed after the present B5.5, so that the section starts with observed changes, not on additional detail. [Markku Rummukainen, Sweden]	Noted. Revised section HS3.1 focuses on temperature extremes. Other extremes are discussed in the other HS3 bullets
109309	14	20	14	20	Suggest replacing "due to" with "by" [Paul Edwards, United States of America]	Noted but this sentence was removed from the revised SPM
80095	14	21	14	22	It would be better if it were specified how urbanization modifies the effects and which effects of climate change (urban heat island happens without climate change and many big cities try to reduce its effects). Also, precipitation patterns are not changed by "cities", maybe it is the case in the largest megacities and only for the convective part of it. We suggest changing the text accordingly. [Lilian Fejes, Hungary]	Noted. This sentence is not longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."

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81895	14	21	14	22	Suggest adding "via the urban heat island effect" after "Urbanization has exacerbated the effects of global warming in cities" if that is indeed the reason. Otherwise it's not clear what this means [Dan Zwartz, New Zealand]	Noted. This sentence is no longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."
29403	14	22	14	22	Unclear whether the modification of precipitation patterns by urban areas could be counted to extreme impacts, rather flooding subsequent of extreme precipitation is amplified by surface sealing. It is further not clear from the passage which processes are linked to the precipitation modification. [Joachim Fallmann, Germany]	Noted. This sentence is no longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."
26027	14	22	14	25	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
129977	14	22	14	25	Revise the sentence "Changes in aerosols..." to "In particular, changes in aerosols...". Revise the sentence, "Irrigation and crop expansion..." to "Also, irrigation and crop expansion..." [Trigg Talley, United States of America]	Noted but this text was removed from the revised section HS3
101559	14	22			Change "and modified precipitation patterns" to "and has modified precipitation patterns" [Knute Nadelhoffer, United States of America]	Noted. This sentence is not longer in section HS3. It is included in section HS11: "Predominantly at night, urban areas are generally warmer than their surroundings (very high confidence). Urbanization alters the water cycle, generating increased precipitation over and downwind of cities (medium confidence), and increasing runoff intensity (high confidence). Large implications are expected from the combination of future urban development and the more frequent occurrence of extreme climate events (very high confidence). In coastal cities, the combination of extreme sea level and extreme rainfall/river flow events will increase the probability of flooding (high confidence)."

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29405	14	25	14	25	why is the effect of aerosol concentration on warming attenuation most pronounced from 1950-1980? [Joachim Fallmann, Germany]	Noted but this text was removed from the revised SPM
27873	14	25	14	25	We suggest to be double check the statement on crop expansion, especially the confidence associated to this. We do agree that this is true for irrigation, but we are not so confident about the impact of crop expansion that is probably not so robust or not supported by sufficient literature. [Eric Brun, France]	Noted but this text was removed from the revised SPM
93745	14	25	14	26	There is limited understanding of the overall effect of crop expansion, with deforestation (often a corollary of crop expansion) having been shown to increase the intensity of summer hot extremes (Lejeune et al, 2018) and Mueller et al (2017) overall finding no significant influence of crop expansion on summer hot extremes. Mueller et al (2017) have however pointed at the strong cooling impact of cropland intensification for hot extremes in some mid-latitude agricultural basins, an impact that they estimated to be stronger than that of irrigation. This justifies to replace "crop expansion" by "crop intensification" in this paragraph. Lejeune et al, 2018. Historical deforestation locally increased the intensity of hot days in northern mid-latitudes, Nature Climate Change Mueller et al, 2017. Global Relationships between Cropland Intensification and Summer Temperature Extremes over the Last 50 Years, Journal of Climate Thiery et al, 2017. Present-day irrigation mitigates heat extremes, JGR [Quentin Lejeune, Germany]	Noted but this text was removed from the revised SPM
40565	14	25	14	26	No mention that there is "...medium confidence that deforestation has contributed about 1/3 of the total warming of hot extremes in some mid-latitude regions since pre-industrial times" (Ch11). An important finding. [TSU WGI, France]	Noted but this text was removed from the revised SPM
129979	14	25	14	26	This isn't quite right as written (at least for central North America). It is a shift to crops that are more intensive consumers of moisture (particularly maize) that is hypothesized to have attenuated increases summer hot extremes (i.e., by increasing humidity rates due to higher rates of evapotranspiration). [Trigg Talley, United States of America]	Noted but this text was removed from the revised SPM
104129	14	25	14	26	Highlighting the special case of central North America without describing the situation for the vast majority of other regions is undesirable. Please delete this sentence, or rebalance it by presenting the findings for the other regions and mentioning the negative impacts of irrigation (e.g., water depletion). [Philippe Tulkens, Belgium]	Noted but this text was removed from the revised SPM
50217	14	26	14	26	Suggested edit: 'such as the central North America' (delete 'the') [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted but this text was removed from the revised SPM
90763	14	29	14	30	The temporal scale is missing in this statement: are hot and cold extremes of days, months, years? Precise, please. [José Romero, Switzerland]	Accepted. Revised section HS3.1 now states: "It is virtually certain that the frequency and intensity of hot extremes and the intensity and duration of heatwaves have increased across most land regions since 1950, while cold extremes have become less frequent and severe."
40563	14	29	14	38	No mention that there has already been "an increase in the intensity and duration of heatwaves" (Ch11 ES) [TSU WGI, France]	Accepted. Section HS3.1 discusses heatwaves

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66519	14	29	14	38	Heat stress and high temperature thresholds impacting health, agriculture and other sectors have medium confidence of increase and could be mentioned, but these statements should be improved and homogenized in CH12 {12.4}; CH12 can contribute to this; [robert vautard, France]	Noted. Section HS3 focuses on hot extremes but not in CIDs
53479	14	29	14	38	what about heat stress? [Hervé Douville, France]	Noted. Section HS3 focuses on hot extremes but not in CIDs
104131	14	30	14	31	The metric used for comparing "trends" should be clarified, perhaps in a footnote. It may be useful to compare the trend in "extremes on land" also with the trend of the mean on land (rather than just the global mean). [Philippe Tulkens, Belgium]	Noted but this sentence was removed from the revised SPM
104133	14	30	14	31	Replace "global mean temperature" with GSAT or GMST, as appropriate. [Philippe Tulkens, Belgium]	Rejected. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
129981	14	30	14	32	Confusing. Are trends in extremes on land being compared to trends in global mean temperature or trends in extremes of global mean temperature? [Trigg Talley, United States of America]	Noted. Bullet HS3.1 now focuses on temperature.
80097	14	30	14	37	It is not clear how trends in temperature extremes can be intercompared with global mean temperature. Kelvin vs. days or % and how can be the difference 50-200%? Or does the sentence mean that the trends on land is 50-200% larger than the globally averaged trends? Please try to rephrase this sentence. The last sentence of this paragraph makes it also confusing: the continental scales are consistent or lower than the global ones? [Lilian Fejes, Hungary]	Noted but this sentence was removed from the revised SPM
131709	14	31	14	32	global mean temperature - surface or air? [Hans Poertner and WGII TSU, Germany]	Noted but this sentence was removed from the revised SPM
25853	14	31	14	32	Please specify whether "global mean temperature" refers to GSAT. [Don Alfonso Pino Maeso, Spain]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
80099	14	33	13	36	The 3rd sentence in this paragraph is a repetition of the 1st one and the one part (it is extremely likely that human influence is the main contributor to it) could be added at the end of the 1st sentence. Also, it is not clear what is the difference between this and the next sentence: the medium and extremely wording could be confusing. [Lilian Fejes, Hungary]	Noted but this sentence was removed from the revised SPM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41815	14	35	14	35	Note the strong role of the land cover changes and human demands in the Mediterranean. Climate is not the main driver of hydrological drought trends in this region: Vicente-Serrano, S. M., Peña-Gallardo, M., Hannaford, J., Murphy, C., Lorenzo-Lacruz, J., Dominguez-Castro, F., et al. (2019). Climate, irrigation, and land-cover change explain streamflow trends in countries bordering the Northeast Atlantic. <i>Geophysical Research Letters</i> , 46, 10821–10833., Teuling, A. J., de Badts, E., Jansen, F. A., Fuchs, R., Buitink, J., van Dijke, A. J., & Sterling, S. (2019). Climate change, re-/afforestation, and urbanisation impacts on evapotranspiration and streamflow in Europe. <i>Hydrology and Earth System Sciences Discussions</i> , 2019, 1–30. https://doi.org/10.5194/hess-2018-634 , García-Ruiz, J. M., López-Moreno, J. I., Vicente-Serrano, S. M., Lasanta-Martínez, T., & Beguería, S. (2011). Mediterranean water resources in a global change scenario. <i>Earth-Science Reviews</i> , 105(3–4). https://doi.org/10.1016/j.earscirev.2011.01.006 [Sergio Vicente-Serrano, Spain]	Noted. This SPM corresponds to WGI. Impacts like those mentioned by the reviewer are evaluated by WGII
39853	14	35	14	36	"The available evidence suggests that some recent hot extreme events could not have occurred without human influence (medium confidence)." -> Worthy of being included in the headline statement as this is a major finding. [TSU WGI, France]	Noted. However, the main headline statement has been summarized. Details are discussed in the supporting bullets in HS3.
25855	14	35	14	36	Please consider replacing "could not have occurred" by "would have been extremely unlikely to occur" in accordance with chapter 11, page 49, lines 2-3:"Some specific recent hot extreme events would have been extremely unlikely to occur without human influence on the climate system" [Don Alfonso Pino Maeso, Spain]	Noted but this sentence was removed from the revised SPM
129983	14	35			Revise the sentence "The available evidence suggests that some recent hot extreme events..." to "Evidence indicates that the intensity of some recent extreme hot events..." [Trigg Talley, United States of America]	Noted. This sentence was rewritten
50219	14	36	14	36	Extreme temperature trends on regional to continental scales' - please could you clarify if this statement corresponds to both land and ocean regions? Presumably this includes marine heatwaves, "which have become more frequent (high confidence), and persistent (medium confidence)"? LOS: Chapter 9, executive summary, page 7, line 41-42. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted but this sentence was removed from the revised SPM
108261	14	36	14	36	A more elegant formulation would be "would not have occurred" ("would" rather than "could"). [Johannes Quaas, Germany]	Noted but this sentence was removed from the revised SPM
129985	14	36	14	37	Remove the last sentence "Extreme temperature trends on regional to continental scales are generally consistent with global-scale trends." It weakens, if not contradicts, the prior sentence (line 30-32) that states "Trends in temperature extremes on land are generally larger (50% to 200%) than those in global mean temperature..." [Trigg Talley, United States of America]	Accepted. The sentence was removed.
44747	14	37	14	37	Which global-scale trends? In extreme temperature or mean temperature? [Markku Rummukainen, Sweden]	Noted but this sentence was removed from the revised SPM
80401	14	40	14	45	CH8 also provides support for these statements (section 8.3.1.3, page 8-36, lines 24-26) [Paola Arias, Colombia]	Noted but final chapter 8 does not discuss precipitation extremes
65555	14	40	14	45	Suggest clarifying that the difficulty in observations are the limiting factor in making more confident statements. [Kushla Munro, Australia]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence)"
104135	14	40	14	45	B5.3 consider combining with B2.4 [Philippe Tulkens, Belgium]	Rejected. Revised section HS3 focuses on weather and climate extremes.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104391	14	40	14	45	The likelihood of anthropogenic influence on observed increase of heavy precipitation over land regions is "very likely" not just "likely" given the wealth of study reports published since the completion of this draft. See, for example, Human influence has intensified extreme precipitation in North America by Megan C. Kirchmeier-Young and Xuebin Zhang. PNAS first published June 1, 2020 https://doi.org/10.1073/pnas.1921628117 [Hunter Cutting, United States of America]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
80101	14	40	14	45	The 3rd sentence could be added right after the 1st one to avoid repetition. Are there any regions where 1-day or 5-day precipitation maximums decreased? It would be interesting to mention them. Also, In what way did the seasonality of floods change in cold regions? Please try to specify it. [Lilian Fejes, Hungary]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
129987	14	40			Revise the first sentence to read "There is high confidence that heavy daily precipitation events have intensified..." [Trigg Talley, United States of America]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
25857	14	41	14	41	Please consider replacing "5-day" by "5-consecutive day" as stated in chapter 11, page 58, lines 21-22. [Don Alfonso Pino Maeso, Spain]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
87179	14	41	14	42	This sentence is quite hard to read/understand for a non-expert reader and could with benefit be simplified or explained better. [Oyvind Christophersen, Norway]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
53481	14	41	14	42	complete with "and that the increase is even stronger when focusing either on hourly precipitation rates or on entire wet events rather than on fixed time intervals."? [Hervé Douville, France]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
129989	14	42	14	42	What constitutes a "region", and how many are there when comparing increases in annual max amount of 1-day or 5-day precipitation? [Trigg Talley, United States of America]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
129991	14	43			Revise the end of the sentence "...in land regions." to "...over land regions on a global scale." [Trigg Talley, United States of America]	Noted. Section HS3.2 states: "The frequency and intensity of heavy precipitation events have increased over the majority of land regions with good observational coverage (high confidence), and human influence is likely the main driver."
25859	14	44	14	44	It would be useful to have more details on the change of seasonality of floods alluded in this sentence. [Don Alfonso Pino Maeso, Spain]	Noted but this sentence was removed from the revised SPM
44749	14	44	14	44	How has the seasonality changed? [Markku Rummukainen, Sweden]	Noted but this sentence was removed from the revised SPM

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129993	14	44			Remove "cold" since snow melt affects remote flood risks, such as on the lower Mississippi River in spring from snow melt in the far northern headwaters and is more consistent with the text in TS-45, lines 9-10. [Trigg Talley, United States of America]	Noted but this sentence was removed from the revised SPM
9499	14	45	14	45	Should reference chapter 8 if you are mentioning extreme precipitation. See section 8.3. [Joelle Joelle Gergis, Australia]	Noted but final chapter 8 does not discuss precipitation extremes
116095	14		14		The HS on wildfire and heat waves is not supported by a corresponding bullet point. The bullet point on cyclones is not reflected in the HS. [Valerie Masson-Delmotte, France]	Noted. Revised bullet HS3.5 deals with fire weather while HS3.1 focused on heat waves
110807	15	0	15	0	explain ca. I am not sure what it means [cathy clerbaux, France]	Not applicable. Table removed from the SPM.
110809	15	0	17	0	SPM1 This table is quiet long-try to avoid acronyms (LMT etc) [cathy clerbaux, France]	Not applicable. Table removed from the SPM.
90253	15	0	18	0	Table SPM1.:the text ca. +0.5°C global warming is not clear. For the 10th-12th rows the direction of change is not shown. The compound events row could be separated or could try to be more specific,the flooding risk could be erased from there as it appears already beforehand. [Bernadett Benko, Hungary]	Not applicable. Table removed from the SPM.
8137	15	1	15	1	What exactly is meant with 'drought potential'? The risk for droughts? This terminology should probably be explained to be useful for policy makers. [Frank Dentener, Italy]	Noted but this sentence was removed from the revised SPM
104137	15	1	15	1	What exactly is meant with 'drought potential'? The risk for droughts? This terminology should probably be explained to be useful for policy makers. [Philippe Tulkens, Belgium]	Noted but this sentence was removed from the revised SPM
129995	15	1	15	2	[DROUGHT] A complete rewrite of the first sentence is required. Repeat suggestions for this same sentence that appeared in B.5 overarching summary. "Drought potential" is a non-standard phrase. It isn't even clear what physical concept is being alluded to with such usage. At minimum, define "drought potential" and discuss the concept in Box SPM.1. Or, better yet, speak about "drought" directly. The statement itself for an "increase in drought potential potential in the dry season when aggregated on the global scale" is convoluted and needs to be rewritten/simplified. [Trigg Talley, United States of America]	Noted but this sentence was removed from the revised SPM
97275	15	1	15	2	Please clarify, if the "human influence on drought potential" is due to climate change or to water management or both. [Nicole Wilke, Germany]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)." We do not mention drought potential in the revised SPM.
51989	15	1	15	3	Panel A of the figure (I could not find a number for that figure). The legend shows 5 SSPs, but there are 6 lines. To which SSP do the two grey lines pertain? [Daniel Rosenfeld, Israel]	Not applicable. We cannot identify the figure referred to. The figures showing SSPs do not have extra grey lines.
50223	15	1	15	6	It may not be clear to a policymaker what the distinction is between drought and drought potential, so this should be explained and clarified. The need for this text could be removed by instead quoting section 8.3.1.8, which states "it is very likely that the frequency and the severity of droughts has increased over the last decades in the Mediterranean, western North America and Australia. These changes can be attributed to anthropogenic warming in the Mediterranean (high confidence), South Africa (medium confidence), and Australia (medium confidence)", or similar wording. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted but this sentence was removed from the revised SPM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108339	15	1	15	6	12.4.1 should be included in the line of cite [Nana Klutse, Ghana]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)." Therefore Chapter 12 is not included in the line of sight
86109	15	1	15	6	Is there a confidence statement on intensity of drought and general drying in drylands? Statistically, detecting a significant change in drought frequency is limited by the length of the time series and definition of 'drought'. What evidence is there on changes in absolute rainfall in drylands? Even a minor decrease in rainfall where rain is already limiting can have devastating effects. Please add something along these lines. [Debra Roberts and the Durban WGII TSU, South Africa]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)." Therefore Chapter 12 is not included in the line of sight
86963	15	1	15	6	Please consider adding that accelerated water cycling and drought stress/soil moisture deficit typically derive from a combination of climate impact drivers, from (site-specific) impoverished soils with lower retention capacity to (large scale) changes such as altered temperatures and precipitation patterns. Rationale: Degraded soils have lower capacities for managing water, whether there is too much or too little. Where precipitation/water supply is limited, and temperatures/potential evaporation high, water shortages will be exacerbated by poorer soils with less water holding capacity. Such combined soil/water stress will have various feedback-effects for climatic factors on site, including increasing heat stress on site as increasing water stress cause reduced evaporative cooling. On the other hand, impoverished soils may also be a cause for problems where precipitation/water supply is plentiful, as water retention will be hampered leading to higher fluctuations in discharge downstream. Better soils will have higher water retention, so water will be available to even out heat stress and drought stresses. If these issues are delat with in WGII, please coordinate across WGs. [Oyvind Christophersen, Norway]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)." Therefore Chapter 12 is not included in the line of sight
20927	15	1	15	6	The notion that human influence has increased drought potential in 20th Century is not clear and some how confusing. I thought we will re-enforce the wider impacts of climate change . Unfortunate no citation has been indicated for this conclusion. [Ladislaus Chang;a, United Republic of Tanzania]	Noted but this sentence was removed from the revised SPM
69363	15	1	15	6	It would be useful if assessment on wildfires, as explained in summary of B.5 and Table SPM.1, were explicitly descripted in subsection of B.5 such as B5.4, which is related to dry extremes. [Kaoru Magosaki, Japan]	Noted. We do not mention wildfires in the revised SPM. We now focus on fire weather. Section HS3.5 states: "The probability of compound events has likely increased since 1950. This includes increases in the frequency of concurrent heatwaves and droughts (high confidence), fire weather in the Mediterranean region, northern Eurasia, the United States, and Australia (medium confidence), and compound flooding (high confidence). The land area affected by concurrent extremes has increased (high confidence)."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
64793	15	1	15	13	As noted in Table SPM.1 there appears to be sufficient evidence to conclude anthropogenic influence is a cause, or the main cause, of the effects of drought potential. Recommend adding language to the narrative for consistency with other passages in this section (extreme precipitation, hot/cold events) and to make the distinction clear. Additionally, while line 11 contains language regarding probability of cyclone intensity that cannot be explained by natural variability, it does not necessarily equate to anthropogenic influence. It may be intentional due to sufficiency of evidence to make a more conclusive statement; however, a statement on the impact of human influence may be considered as well. [Casey Kopcho, United States of America]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)."
129997	15	1	18	1	Table cells are not consistent throughout the table. Suggest deleting redundant words/phrasing. For example, cells with the "human contribution to the observed trends" column should not repeat phrases like "main contributor", "human influence", "20th century" because these are given from the column title. Table cells should also be concise and quickly digestible. Specific data results should be limited to the summary text. Strive to make cells similar to the rows: "warm spells, heatwaves; increase in frequency or intensity over most land areas". [Trigg Talley, United States of America]	Noted but this table was removed from the revised version
98011	15	1	18	50	Table SPM.1 For second column, the whole title for the column "Observed/detected" is ambiguous. These are two very different things (on implies emergence has been demonstrated for the signal; the other does not) yet the table entries are often not specific on which is meant. So the first table entry should be: "Detection is virtually certain on global scale." Each entry or subentry in the table should specify whether it is a "detectable increase", "detectable decrease" or just an "increase/decrease". For example, the entries later on for "Tropical cyclone track changes" do not say the changes are detectable (and in my opinion they are not—at the medium confidence level). Be consistent and clear on what is meant for each sub-entry. [Thomas Knutson, United States of America]	Noted but this table was removed from the revised version
36137	15	1			This is good, but you really should point out that this is LULUCF and NOT GHGases as implied. Any GHG-driven change "since begin of 20th century" are surely not attributable. [Michael PRATHER, United States of America]	Noted but this sentence was removed from the revised SPM
107989	15	2	15	2	drop "the" prior to "dry season" because there is no single dry season across locations, there are different dry seasons [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)."
44751	15	2	15	3	Why "when aggregated on the global scale"? The trends are presumably larger in some regions than others. Variability an issue? [Markku Rummukainen , Sweden]	Noted. Section HS3.2 now states: "Human influence has contributed to drought in particular during the dry season over most land areas due to increases in atmospheric evaporative demand (medium confidence)." We do not mention drought potential in the revised SPM.
50225	15	3	15	3	There is medium confidence that some regions show more frequent hydrological droughts' - does this statement also correspond to between the start of the 20th century and now? (as with the opening statement of B5.4)? If so this sentence could start with: 'Over this period, there is medium confidence...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Yes, this statement was referring to the same time scale but in the final version of this section the statement has been removed and the reader is referred to the underlying chapters 8 & 11.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9501	15	3	15	4	Southern Australia should be added to the list as per section 8.3.1.8 [Joelle Joelle Gergis, Australia]	Noted. The final version does not include a list of regions anymore, these can be found in the underlying chapters 8 and 11.
35269	15	3	15	4	I believe this is confined to southwestern North America, not southern--which would imply places like Alabama, Florida, etc..where the Palmer Indices ("hydrological" measures) don't show any significant trends. [patrick Michaels, United States of America]	Rejected. The literature assessed for this statement (based on several indices) shows indeed significant trends when averaging over the IPCC region Western North America.
129999	15	3	15	4	Clarify the meaning of the statement "...more frequent hydrologic droughts, predominantly southern Africa, southern North America, the Mediterranean region." For instance, is the claim being made about the occurrences of low flows on major rivers happening more often? The authors should be more precise on the rivers involved, if that is the target of their claim. In particular, is the reference to "southern North America" addressing river flows in the Mississippi, the Colorado River, or the Rio Grande to name a few major rivers that reside in southern North America? The evidence of change in hydrologic droughts in these individual rivers is for very different behaviors, and so this broad-statement in lines 3-4 is inappropriate, at least for southern North America. [Trigg Talley, United States of America]	Noted. The assessment of hydrological droughts has been removed from the SPM and the reader is referred to the underlying chapters which provide more space for clear statements.
97277	15	3	15	4	"There is medium confidence that some regions show more frequent hydrological droughts, predominantly southern Africa, southern North America, the Mediterranean region." Please mention if this is different from the SRCCL. [Nicole Wilke, Germany]	Noted. The assessment of hydrological droughts has been removed from the SPM and the reader is referred to the underlying chapters which provide more space for clear statements.
45213	15	3	15	5	There are some differences with the assessment in Chapter 8 {8.3.1.8} which says that the frequency and the severity of droughts has increased over the last decades in the Mediterranean, western North America and Australia. On the other hand, the SPM doesn't mention Australia, whereas it mentions southern North America. The attribution of the recent increase in frequency of droughts over the Mediterranean to anthropogenic warming is assigned high confidence in Chapter 8, but medium confidence in the SPM. The inconsistencies across Chapter 8 and SPM needs to be resolved. [Krishnan Raghavan, India]	Noted. thank you, these inconsistencies have been addressed. The SPM only refers to agricultural and ecological now and refers to "some regions" rather than listing all.
108263	15	3	15	5	The sentence would be better if more specific. Why not “ There is medium confidence that regions including southern Africa, southern North America, the Mediterranean show more frequent hydrological droughts.” [Johannes Quaas, Germany]	Noted. The assessment of hydrological droughts has been removed from the SPM and the reader is referred to the underlying chapters which provide more space for clear statements.
50227	15	4	15	4	In the underlying chapter 11, there isn't an obvious line of sight for the statement about southern North America. It appears in the Executive Summary, but not in the underlying sections. Please could you work with Chapter 11 authors to amend and ensure consistency across the report? I have commented similarly on Chapter 11. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This lack of line of sight has been addressed in chapter 11. The final version of the SPM does not list regions anymore in this statement.
130001	15	4	15	4	*and* the Mediterranean [Trigg Talley, United States of America]	Noted. Specific regions are not listed in the final SPM statement.
29407	15	4	15	4	and the Mediterranean [Joachim Fallmann, Germany]	Noted. Specific regions are not listed in the final SPM statement.
27875	15	4	15	4	The drying of the Mediterranean region is not really visible on Fig. SPM5. Southern Africa also seems to exhibit increasing precipitation. Maybe this depends on the time period chosen on Fig. SPM5? [Eric Brun, France]	Noted. The final version of SPM.5 shows a decrease in precipitation in Southern Africa and the Mediterranean at all three warming levels shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25861	15	4	15	5	Please consider adding to this sentence "over the last century" and "due to human influence" as stated in chapter 11 , page 112, lines 29-30 : "There is high confidence that concurrent heatwaves and droughts have increased in frequency over the last century at a global scale due to human influence". [Don Alfonso Pino Maeso, Spain]	Accepted. The statement has been revised to include the timeframe and the cause of the observed change.
53483	15	4			also Australia? [Hervé Douville, France]	Noted. Specific regions are not listed in the final SPM statement.
104393	15	8	8	13	Discussion of trends in tropical cyclones should be extended to increases in precipitation and storm surge drive by sea level rise, providing a holistic view, parallel to the view of drought presented in the section immediately above in B.5.4 [Hunter Cutting, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
37633	15	8	15	8	It is not very clear what is meant by "probability". [Masahide Kimoto, Japan]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
39703	15	8	15	9	"...probability of exceeding major tropical cyclone intensity (Category 3 or greater) has increased over the past 40 years" -> This is phrased differently in the Ch11 ES: "...the global proportion of stronger tropical cyclones (TCs) has increased detectably over the past 40 years.". I think the ES phrasing is easier to understand, although the categories should be stated. [TSU WGI, France]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
35271	15	8	15	9	Very convenient that you pick the last 40 years! Where we have good TC data--in the Atlantic--it appears that the period 1930-1960 saw similar cyclone activity to 1980-2010 in the HURDAT record from the US National Hurricane Center. Further, Ryan Maue's global ACE index starting in 1970 shows no systematic changes related to warming. Give that the ACE index integrates the dynamic power of tropical cyclones, the fact that there's little net change, despite warming oceans, should be pointed out. [patrick Michaels, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
130003	15	8	15	9	It might be more scientifically robust to include the period of time for which consistent records for tropical cycling intensity exist, while noting when satellites were used to help observe tropical systems. [Trigg Talley, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108265	15	8	15	9	The sentence is difficult to understand. Is it "There is medium confidence that Tropical cyclone intensity more frequently is of category 3 or higher since at least 40 years." [Johannes Quaas, Germany]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
53485	15	8	15	9	May be add that there is high confidence that atmospheric moisture has increased over the tropical oceans due to global warming, thereby strengthening the potential for heavy cyclonic precipitation. [Hervé Douville, France]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
105589	15	8	15	13	I cut-and-paste the SROCC statement here as confidence levels are quite different "Anthropogenic climate change has increased observed precipitation (medium confidence), winds (low confidence), and extreme sea level events (high confidence) associated with some tropical cyclones, which has increased intensity of multiple extreme events and associated cascading impacts (high confidence). Anthropogenic climate change may have contributed to a poleward migration of maximum tropical cyclone intensity in the western North Pacific in recent decades related to anthropogenically-forced tropical expansion (low confidence). There is emerging evidence for an increase in annual global proportion of Category 4 or 5 tropical cyclones in recent decades (low confidence)." [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
29409	15	8	15	14	More details needed on the implications/consequences of northward moving of the peak of tropical cyclone wind intensity [Joachim Fallmann, Germany]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
36139	15	8			"exceeding" what does this mean here? try to rephrase [Michael PRATHER, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
82533	15	9	15	9	Should specify Saffir-Simpson Category 3 as different category systems are in use in some regions (also in Table SPM.1 and P30 L12). [Blair Trewin, Australia]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
130005	15	9	15	11	Is there really strong evidence to say that it's very likely that the averaged location of peak tropical cyclone wind intensity has migrated poleward in the western North Pacific Ocean since the 1940s before the satellite period? [Trigg Talley, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
69365	15	10	15	11	It would be better to add reasons why locations of tropical cyclone in the western North Pacific Ocean have shifted poleward since the 1940s. [Kaoru Magosaki, Japan]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
8139	15	11	15	11	Is this the same as medium confidence that it related to anthropogenic. Such phrasing would be more direct and clearer. [Frank Dentener, Italy]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
104139	15	11	15	11	Is this the same as medium confidence that it related to anthropogenic. Such phrasing would be more direct and clearer. [Philippe Tulkens, Belgium]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
44753	15	11	15	11	This is a complicated expression. What would be the confidence of attribution to anthropogenic forcing as explanation? Or is there only one reference than has done the analysis, in this way? [Markku Rummukainen , Sweden]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36141	15	11			The negative and the confidence language in this sentence are hard to read. [Michael PRATHER, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
42655	15	11			Could usefully be reworded to 'there is medium confidence that the change can be attributed to anthropogenic induced warming' - [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
130007	15	11			[CONFIDENCE] Confidence level for detectable (unusual compared to natural variability) increase in proportion of stronger TCs should be low confidence. If IPCC allows split confidence levels, the authors could consider between low confidence and low-to-medium confidence. One can say with medium confidence it has increased, but we don't really know why, and we don't have medium confidence that the increase is unusual compared to natural variability. Rationale: The conclusion that there is medium confidence that an increase in proportion of stronger TCs globally has become detectable is based on the likely increase in the proportion of stronger TCs globally over the past 40 years, and the statement that this is consistent with theoretical understanding and numerical simulations (citing Knutson et al. 2015, 2019b, and Walsh et al. 2015, 2016, Bender et al. 2010 and Kossin et al. 2013). Also cited is the new Kossin et al. (2020) manuscript reporting the observed trend. None of these studies provide convincing evidence that the change reported by Kossin (2020) is outside the range of behavior expected from natural variability -- which is what must be demonstrated for detection. This is different from finding that an observed change over some time period is similar to a modeled signal. One must still show that the change is highly unusual compared to natural variability, otherwise such agreement with a projection could be coincidental and not indicating detection. One way detection could be done is to compare the observed trend in the metric to a distribution of trends in climate model long control runs or large ensembles of natural forcing only runs. The modeled signals cited in the above papers are not comparable to the observed change in Cat 3-5 proportion in any case. Further, Bender et al. (2010) and Knutson et al. (2015) are based on future climate change scenarios, not historical simulations and so are not really comparable to observed changes over the historical period. The 10% per decade increase in Cat 4-5 numbers in Bender et al. (2010) was reduced somewhat in their expanded simulation study for the Atlantic (Knutson et al. 2013) and their	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130009	15	11			[CONFIDENCE] Confidence level for detectable (unusual compared to natural variability) increase in latitude of maximum intensity in NW Pacific should be low-to-medium confidence (if IPCC allows split confidence levels), otherwise low confidence. One can say with medium confidence it has increased, but we don't really know why the increase has occurred, and we don't have medium confidence that the increase is unusual compared to natural variability. Rationale: The WMO TC/climate assessment (Knutson et al. 2019a) assessed this finding. The author team for that report expressed the following opinion on confidence levels (Table 1): low to medium confidence: 8 authors; medium confidence: 1 author; medium to high confidence: 2 authors. IPCC does not report distribution of opinion, but a single confidence level. This case study was discussed in detail in Knutson et al. 2019a, and there have been no new published findings on it since that assessment. The methodology of assessing how unusual the observed change is compared to natural variability consists of regressing out ENSO, PDO (or IPO), and the AMO, and examining trend of the residuals. This assumes that natural multidecadal variability in the metric is linearly related and well described by some combination of the predictors with little influence of any other process (e.g., atmospheric internal variability, coupled variability unrelated to the predictors) not included in the predictor list. The ability of these predictor variables to statistically describe the variability of the TC metric could be more thoroughly explored using climate model control runs which would give more confidence, though not complete confidence in this methodology. [Trigg Talley, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
9729	15	12	15	13	Careful with the end of B.5.5. which could be twisted as"Even the IPCC admits ..." [Jonathan Lynn, Switzerland]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
65559	15	12	15	13	Suggest reviewing. This conclusion does not take into account reliable records from landfalling TCs based on wider range of sources including historical data. see e.g. Callaghan and Power (2011; climate dynamics) - updated in AR5.Arguably, there is medium confidence that the frequency of severe (i.e. cat 3-5) tropical cyclones making landfall over north-eastern Australia has declined since the late 19th century. [Kushla Munro, Australia]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
9621	15	12	15	13	I am not sure how to understand this sentence out of context. There are trends but there is low confidence that there are significant. There is no trends, but then why low confidence ? There may be a trend or not ? Low confidence should be attached to a statement. [Olivier Boucher, France]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130013	15	12	15	13	Strike the last sentence of Section B.5.5 to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
130011	15	12			Edit "...tropical cyclones..." to "...tropical cyclone..." [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
25863	15	13	15	13	Please consider including adding 1850-2018 to "period of instrumental record" as stated before in page 5 of this SPM. [Don Alfonso Pino Maeso, Spain]	Noted. This was rewritten: It is likely that the proportion of tropical cyclones that are categorized as intense has increased over the last four decades; this change cannot be explained by natural variability alone (medium confidence). Event attribution studies provide high confidence for human -caused increases in heavy precipitation associated with tropical cyclones."
42021	15	16	15	16	FIG SPM.6 is very hard to read. Most of the map is without information. Wouldn't a table be easier to read? [Juhani Damski, Finland]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
44067	15	16	15	31	We appreciate the effort undertaken to "show that we have now a lot of evidence that is attributed to anthropogenic climate change in different regions of the world for many different types of extreme events" that figure SPM.6 intends to summarise. However, the underlying assessment appears to be too restrictive regarding 2 important aspects to fully fulfil its stated purpose: 1) it only considers impacts for which a corresponding event has been studied in the event attribution framework. This leaves out a substantial body of literature on e.g. trend attribution. As an example, the current figure indicates no signal for droughts in many African regions, such as West Africa, North and Central Eastern Africa. However, the Atlas details some drying trends in these regions (see Atlas.5.2), and attributes some of these to anthropogenic activities. 2) it considers a limited set of extreme events or climatic impact drivers, leaving out some that have high regional relevance such as marine heatwaves, changes in glacier/snow/land ice, etc. [Lamin Mai Touray, Gambia]	Noted. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. The interactive Atlas provides more granular information. We chose to show only three types of extremes to give an indication of the types of changes that occur and are relevant, they are not intended to be comprehensive.
93747	15	16	15	31	The lone consideration of events that have been studied in the event attribution framework strongly limits the body of literature that this Figure reflects, and thus diminishes its relevance. To increase the comprehensiveness of the results shown by the Figure, other methodologies should be considered, e.g. trend attribution. Moreover, the inclusion of events for which no signal was reported does not serve the purpose of "[showing] that we now have a lot of evidence that is attributed to anthropogenic climate change". [Quentin Lejeune, Germany]	Noted. The final version of this figure, SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. One intend of the figure is to show where evidence is currently limited.
93749	15	16	15	31	The season labels are very difficult to read. But is there a need for such a level of detail here? [Quentin Lejeune, Germany]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28119	15	16			Regarding Figure SPM.6: - This figure contains a lot of information. For the sake of readability, would it be possible to put it in landscape layout? If it's still hard to read, color codes might be easier to read than little icons. - The fact that attribution studies show that human activities are responsible for all presented events in this figure could be enhanced. - France has a major concern with the current division of Europe into geographic domains, especially for the Central Europe domain. Indeed, the current "Central Europe" covers a domain with completely different climates. We strongly recommend to choose a new division which makes it possible to separate the Western part of Europe, which has a maritime climate, from the Eastern part which has a continental climate. If it is not the case, all Tables and messages in the vol1 SOD SPM and Chapters referring to the current "Central Europe" would be completely meaningless and useless for France. We recommend to adopt for the Atlas the division mentioned in the first paragraph of 12.4.5. [Eric Brun, France]	Noted. The final version of the figure, SPM3, adopts the set of regions suggested by the Atlas which includes "Western Central Europe" and "Eastern Europe".
42225	15	16			Fig SPM6: Clear symbols, but details are hard to read in small print (e.g. "summer" and "winter" text boxes on top of symbol). How are geographical boxes defined? [Tina Christensen, Denmark]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
28121	15	18	15	18	This is an unusual way to express informations in an IPCC report. The sentence should be reformulated : "... to show that now a lot of evidence is attributed...." [Eric Brun, France]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
65561	15	18	15	19	Suggest clarification in the SPM, for balance, that some observed changes are not consistent with climate change and explain that these are exceptions, and that the overwhelming evidence is consistent. Suggest also explaining why some exceptions occur, e.g. internal variability, imperfect models, imperfect observation. Suggest providing 1-2 examples of this. [Kushla Munro, Australia]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The role of internal variability is explained in the introductory text for section C.
90765	15	18	15	19	Will this italicized text be included in the caption of Fig. SPM.6? What is of interest is whether these individual events across the globe show a trend consistent with anthropogenic climate change. Indeed, this is what Table SPM.1 does. [José Romero, Switzerland]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The role of internal variability is explained in the introductory text for the 3rd section on 'Climate Information for Risk Assessment and Regional Adaptation'.
130015	15	18	15	19	Was this sentence meant to be left in the draft? [Trigg Talley, United States of America]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
37635	15	21	15	22	Figure SPM.6 may be misleading. It may give an impression that symbols indicate that trends of such events are significant and attributable to anthropogenic change, but they are just showing the fact that "one or more such events have been studied". Should it be included in SPM? [Masahide Kimoto, Japan]	Noted. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. The interactive Atlas provides more granular information. One intent of the figure is to show where evidence is currently limited.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20347	15	21	15	28	On figure SPM.6, one is fascinated by the extreme event "sunshine hours", for which a single case is plotted, in the vicinity of British Isles. Although sunshine hours are a significant element of the climate as perceived by most human beings, this WG1 SOD never mentions it elsewhere. Has this extreme event been attributed to anthropic drivers? No sunshine event is mentioned in table SPM.1 either [philippe waldteufel, France]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
26343	15	21	15	28	Different caption font in Figure SPM.6 [María Santolaria-Otín, France]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
36143	15	21			Fig 6 reminds me of the WGII SPM AR5. It was a very interesting figure but drew all sorts of lightning from the governments. Be careful. Also it says the location of symbols is not where the events occurred?? but then why plot on a map. Do you mean they are placed by region of occurrence? [Michael PRATHER, United States of America]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
99977	15	21			We thank the authors for their the effort in capturing extreme events in figure SPM.6. However, it is unclear how this figure compares e.g. to findings presented in Table SPM1. A more comprehensive presentation on all information on attributable extreme events would be beneficial. This figure furthermore has a range of confusing regional gaps, including Central America and the Caribbean among others. Please revise and complement displayed extreme events and regions. [Caroline Eugene, Saint Lucia]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. One intent of the figure is to show where evidence is currently limited.
68799	15	21			Whilst we appreciate the effort of capturing extreme events in figure SPM.6, it is unclear how this figure compares to the findings presented in Table SPM1. A more comprehensive presentation on all information on attributable extreme events would be beneficial. Additionally, the regional gaps, including Central America and the Caribbean, etc. needs to be revised and complement the extreme events and regions. [Jeffers Cheryl , Saint Kitts and Nevis]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. One intent of the figure is to show where evidence is currently limited.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44755	15	25	15	26	This is unclear. Is the "definition of the event" the key point here, or have results also varied in studies which use the same definition? [Markku Rummukainen , Sweden]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution rendering the framing point not applicable anymore. Details on this are assessed in chapter 11.2.
86467	15	31	18	3	Table SPM.1 - this table is useful. There are overlaps with some of the statements in the sections above and these could be removed in order to shorten the text. [Ala Taimar, Estonia]	Noted. Thank you, the table has been removed from the SPM and the information retained in the 1st section on state of the climate. The table can be found in the TS.
66699	15	34	17	2	I'm not sure that elevating a bunch of low confidence statements to the SPM is a good use of space. Could these be bundled more efficiently? [Dave Frame, New Zealand]	Not applicable. Table removed from the SPM.
130017	15	34	17	3	Table descriptions between trend and human columns need to be written in same voice/language throughout. [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.
97279	15	34	18	1	Was the observed trend since 1950 not larger than 0.5 °C? Please see our comment on qualitative estimates of the human influence on an observed change associated with a quantitative uncertainty statement (likelihood). [Nicole Wilke, Germany]	Not applicable. Table removed from the SPM.
38929	15	34	18	2	These overview tables are incredibly helpful and will be a great resource! [Maïke Nicolai, Germany]	Noted with thanks.
86965	15	34	18	2	Table SPM.1 it is very useful with such a summary, it could preferentially be made even more clear and accessible by shortening the text to the essentials [Oyvind Christophersen, Norway]	Taken into account. Table removed from the SPM, to save space.
64751	15	34	18	2	Table SPM.1 : One statement concerning extratropical cyclones consistent with section 11.7.2 should be added. [Serge PLANTON, France]	Not applicable. Table removed from the SPM.
65557	15	34	18	3	Suggest removing the text "... which is expected to increase TC rainfall ..." since this refers to something that has not been detected. Suggest this text be moved to the Future Changes section. [Kushla Munro, Australia]	Not applicable. Table removed from the SPM.
93619	15	34	18	3	Figure SPM.6 is very clear, and the added value of table SPM.1 is low respective to its length. This Table could deleted from here. It would have more of a place in the TS. [Jean-Louis Dufresne, France]	Taken into account. Table removed from the SPM.
78601	15	34			Table SPM1 is huge and complex. Good for TS, but too much for SPM. Can you shorten to 1 page just with key messages? [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table removed from the SPM.
41245	15	36	15	36	Table SPM.1: I feel that the entry on Page 17 on "changes in frequency of TCS" that says "a lack of process understanding of the climate drivers of frequency" is irrelevant. If a robust trend had been observed it would have high confidence irrespective of whether we understand the reasons for that trend. This might argue for an extra column (which I realise would be a lot of work) which indicates whether there is an a priori expectation for a trend in the given characteristic. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
31589	15	36	15	36	Table SPM1: Marine extremes (MHW and sea-level extremes) are missing [Jean-Baptiste SALLEE, France]	Not applicable. Table removed from the SPM.
110805	15	36	15	36	Remove "Summary table... scale" [cathy clerboux, France]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34527	15	36	15	36	Table SPM.1 has more detail about TCs than most other extremes. I rather liked that. [Russell Vose, United States of America]	Not applicable. Table removed from the SPM.
81833	15	36	15	39	The table caption should be slightly reworded as the purpose of the table is to provide "a global level overview of observed changes" or to provide "a large scale overview" but it is not (as currently drafted) about "attribution to human activity on large scales" [Dan Zwartz, New Zealand]	Not applicable. Table removed from the SPM.
93751	15	36	15	40	Table SPM.1: is is deliberate that wildfires are included in the category "compound events"? If so this would require some explanation. [Quentin Lejeune, Germany]	Not applicable. Table removed from the SPM.
20929	15	36	15	40	The detection of trends and assessment of human contribution is Only done from 1950. Why cant we do from 1850 ?. We think that we need to have a complete picture. [Ladislaus Chang;a, United Republic of Tanzania]	Not applicable. Table removed from the SPM.
20931	15	36	17	3	There are number of confusing and contradicting informations from Table SPM 1. Forexample attaching increasing intensity and frequency of heavy precipitation to Human influence and not to increasing warming or climate change is disturbing . We think we are loosing the focus. [Ladislaus Chang;a, United Republic of Tanzania]	Not applicable. Table removed from the SPM.
23383	15	36	18	1	The table contains a lot of repitition from the bullet points (B5.1-5). Is the idea that the governments chose which format they like most? I don't think that the proposed length of the SPM will be able to host both. I like the table, but if it stays I guess that it means that the bullet point should only contain information that is not found in the table. [Anna Amelia Sörensson, Argentina]	Not applicable. Table removed from the SPM.
23385	15	36	18	1	In the table (Human contribution column) I found both "Extremely likely main contributor on global scale" and "Extremely likely on global scale". What is the difference? Does the latter mean "Extremely likely a contributor on global scale"? Just to contribute to a change could mean that the contribution is very low relative to other factors, for example, if it is only stated that human activities contributed, it could mean that this contribution is 1% (even if the likelihood is extreme). So if it is possible to specify the magnitude (main for example) it would be much clearer. [Anna Amelia Sörensson, Argentina]	Not applicable. Table removed from the SPM.
23389	15	36	18	1	Last line in Table SPM.1: "Medium confidence that compound flooding risk has increased along the US coastline." I think that "risk" is not well used here (does not include components vulnerability and exposure). Also, "compound flooding" is not clear. To me compound events would be two or more events that occur at the same time. I think the sentence could be changed to e.g.: "Medium confidence that occurrence of compound extreme events leeding to flooding has increased along the US coastline." [Anna Amelia Sörensson, Argentina]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104395	15	36	18	1	The assessment of "low confidence" in flooding trends presented in table SPM 1 is not due to "little evidence and high seasonality" but rather due to those factors and the confounding influence of development which has dramatically reduced flooding trends. See: USGS publication Flow Modification in the Nations's Streams and Rivers 2019 (https://doi.org/10.3133/cir1461) which reports that due to the "modification of natural flows in streams and rivers... high flows have been reduced in magnitude, are of shorter duration, are less frequent, and vary less from one year to the next than they would naturally." See also Formeta and Feyen, 2019: Empirical evidence of declining global vulnerability to climate-related hazards (https://doi.org/10.1016/j.gloenvcha.2019.05.004) which reports increasing resilience to extreme weather events with increasing development. [Hunter Cutting, United States of America]	Not applicable. Table removed from the SPM.
44757	15	36	18	1	The table would be clearer if it did not state, as is presently done for some of its elements, the specific evidence base for the finding (this information can be found from the underlying chapters), for example what follows "based on..." for the listed phenomena on "tropical cyclones" related issues. This makes the table more cumbersome to read and in SPM, the result would seem to be more important to get across, rather than the methodology behind. [Markku Rummukainen , Sweden]	Not applicable. Table removed from the SPM.
50229	15	36	18	2	Table SPM.1: Is it possible to also include marine heatwaves and flooding due to extreme sea level events in this table? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
87181	15	36	18	2	Table SPM.1 could with benefit be distilled further. As it stands there it too much repetition of text and too little summation. The table headings/top row could also be repeated on each page for ease of reading (if indeed the final version spans several pages). [Oyvind Christophersen, Norway]	Not applicable. Table removed from the SPM.
42227	15	36	18	2	Table SPM1: Very technical terms, e.g. in relation to drought (atmospheric evaporative demand, potential evaporation, water logging) [Tina Christensen, Denmark]	Not applicable. Table removed from the SPM.
42229	15	36	18	2	Table SPM1: Make separate table on tropical cyclones to shorten this one? [Tina Christensen, Denmark]	Not applicable. Table removed from the SPM.
42231	15	36	18	2	Table SPM1: Add description of why the various events can be considered compound events - e.g. flooding and wildfires. [Tina Christensen, Denmark]	Not applicable. Table removed from the SPM.
42407	15	36	18	3	the mix of likelihood and certainty statements may give rise to confusion. The table holds a lot of information but should be condensed [Tina Christensen, Denmark]	Not applicable. Table removed from the SPM.
104141	15	36	18	3	Two more lines should be added to table SPM.1 in order to provide the findings about 1. forest fires and 2 oceans-related extreme (heatwave, storms) [Philippe Tulkens, Belgium]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130019	15	36	18	12	[DROUGHT] The primary weak point in Table SPM.1 is the lack of clarity regarding the assessment of observed changes in drought, and the human contribution. That portion is evasive at best. It doesn't even mention drought event frequency changes, duration changes, or intensity changes. Evaporative demand, a code word for PET, is mentioned, and that is further muddled with the euphemism "drought potential". That is but one measure, and in most cases not the most important measure of drought. Precipitation is. This section could take some pointers from the much better clarity of assessment on drought provided in the recent Climate Science Special Report (https://science2017.globalchange.gov/). In the Chapter 8 Executive Summary, CSSR authors state "While by some measures drought has decreased over much of the continental U.S. in association with long term increases in precipitation, neither the precipitation increase nor the inferred drought decrease have been confidently attributed...." [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.
42023	15	36	18		Table SPM 1. This is very detailed table to be included in the SPM and the key messages that it intends to deliver are not easy to capture. Would it be possible to present the information in the figure? The information could also be included in the Technical Summary instead. In the title +0.5 C is not understandable, please clarify or delete. [Juhani Damski, Finland]	Not applicable. Table removed from the SPM.
36145	15	36			I realize that this is limited by what is in Chapter 11, but the lack of any statements about air quality extremes will be noticed by the govts. If it is mentioned at all (even with a null result) it should be in the SPM. If it is in the literature somewhere then Chapter 11 should put in something (will check Ch .11) [Michael PRATHER, United States of America]	Not applicable. Table removed from the SPM.
85889	15	36			The amount of space in B.5 and table SPM.1 devoted to extremes seems way out of proportion compared to the space allocated to all the other topics in the report. This is more or less repeated in C.5 and table SPM.2. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
27877	15	36			Comment of the Table SPM.1: - cell line 2 (Warmer and/or more frequent hot days and nights over most land areas) column 3: What is the reason to specify "main contributor" in this cell and a few other ones below? - cell line 7 (Drought events: Increases in frequency, intensity and/or duration) column 2: An atmospheric demand cannot display a drying tendency, so this needs to be reformulated. It either increases implying risks to dessicate land, or decreases suggesting potentially loss of water from land. - cell line 8 (Floods and water logging: Increases in intensity and/or frequency) column 1: The term "water logging" is not common and likely to be misunderstood by policymakers. - cell line 8 (Floods and water logging: Increases in intensity and/or frequency) column 3: Is it only high seasonality, not the fact that these are rare events in some regions, with high interannual variations? [Eric Brun, France]	Not applicable. Table removed from the SPM.
54647	15	40	15	40	Table SPM.1: Good to see this table included in the SPM, maintaining continuity with previous IPCC WGI SPMs. Recommend that the ca. +0.5C global warming since 1950 (columns 2 and 3 headings) needs to be anchored to one of the main chapters with a footnote providing where this result can be found. [Nancy Hamzawi, Canada]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108193	15	40	15	40	This table is an example of effectively communicating climate change information to this target audience. This approach should be applied more frequently throughout this chapter. [Anton Holland, Canada]	Noted with thanks.
130021	15	40	15	40	Table SPM.1, first two rows: The formulation "and/or" is redundant. Standard logic truth tables show that the word "or" includes the possibility of A and B both being true. Thus, it is sufficient to just write "or". [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.
78271	15	40	18	1	The responses on human contribution to the phenomenon/trend can be confusing as it is unclear what is the difference between high likelihood and high confidence. In the earlier sections, likelihood is being used to describe the chances of an event/ phenomenon occurring. [Leonie Lee, Singapore]	Not applicable. Table removed from the SPM.
104143	15	40	18	1	Could this table also include an entry on concurrent events in different locations- which could be e.g. of importance for certain climate risks, commodities (e.g. from agriculture) etc., markets. There is literature that could be assessed. [Philippe Tulkens, Belgium]	Not applicable. Table removed from the SPM.
130023	15	40	18	1	Table SPM.1: There is much more detail (four rows) on tropical cyclones than other perils. Consider pruning for brevity. [Trigg Talley, United States of America]	Taken into account. Table removed from the SPM.
65563	15	40	18	2	Suggest reviewing the statements in the Table: 'Warmer and/or more frequent hot days and nights over most land areas' should be classified as 'certain', in line with the established fact on global temperature increases and in line with the evidence. For instance, in the same role; is human influence 'virtually certain' or 'certain'? [Kushla Munro, Australia]	Not applicable. Table removed from the SPM.
89655	15	40	32	1	I find Table SPM.1 and SPM.2 a bit excessive in terms of how much space they take up in the SPM. Can this information be given in a more concise way? And is all of this information required in the SPM, in separate tables for past and future? [Trude Storelvmo, Norway]	Not applicable. Table removed from the SPM.
78273	15	41	15	41	Suggest to make clear what does "ca." in Table SPM.1 mean [Leonie Lee, Singapore]	Not applicable. Table removed from the SPM.
24479	15	49	18	0	The categories in Table SPM.1 are overlapped and they should be improved to increase readability. There are similar phenomena in the table several times (e.g. precipitation) and it is confusing. The categories of phenomena in the table should be classified into two different layers as climate drivers and climatic impact drivers (CIDs). One explaining climate drivers (e.g. circulation, tropical cyclone, convective storms and etc) and the other is CID (e.g. warmer days, cold days, precipitation and etc.). [Nobuhito Mori, Japan]	Not applicable. Table removed from the SPM.
41817	15		15		Drought section: The assessment in this table is not based on frequency/intensity/duration of droughts as suggested on the left, but it only includes an assessment of dryness. I agree with this statement given the role of enhanced atmospheric evaporative demand, but if we focus on drought events we should state that the confidence on drought change is low. [Sergio Vicente-Serrano, Spain]	Not applicable. Table removed from the SPM.
18725	15		18		If the length of SPM is long, this table could be deleted as the current Figure 6 essentially conveys the same message as the table. [Govindasamy Bala, India]	Accepted. Table removed.
17469	15		18		Table SPM.1: I like this table because the information is represented clearly. However, it currently this takes up more than 2.5 pages and it seems to repeat to a significant extent what is already covered effectively in the text. Is this a good use of limited space? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, table removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
110989	15		18		Table SPM.1: While the table lays out information in a different way, this is highly repetitive of what is already covered effectively in the text. Is this a good use of limited space? [Monica Dean, United States of America]	Taken into account, table removed
86111	16	0	16	0	Table: under drought, please add specific statement for drylands, if available. – please remove all acronyms. – re cyclones: move higher confidence statements on cyclone intensity to top of list. These are very important findings. – please also call out results from Indian ocean. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Table removed from the SPM.
97281	16	1			Table SPM.1 : Box "Heavy precipitation events": please add: "high confidence that heavy precipitation intensified on a global scale over land regions" (TS-49-38). Likely more regions ... [Nicole Wilke, Germany]	Not applicable. Table removed from the SPM.
108557	16	17	16	17	Water logging isn't defined anywhere in the SPM or in the glossary. It's a technical term and needs to be defined. [Jason Donev, Canada]	Not applicable. Table removed from the SPM.
25865	16		16		As regards "Drought events: Increases in frequency, intensity and/or duration" it would be useful to also add in the first column (Observed/detected trends) the regional variations that drought phenomena present, in accordance with what stated in Table 11.1 of Chapter 11, page 21:"Observed trends in drought measures are highly regional, with increases in some regions and decreases in others". [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
25867	16		16		Regarding "Increase in precipitation with tropical cyclones"and its second column (Human contribution), there is a contradiction in the confidence statements of the second and third paragraphs (Low to medium confidence and High confidence) and the confidence statements for these same paragraphs in TS 7 (Technical summary page 53) and Table 11.1 in Chapter 11, page 21 which are Medium confidence for both. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
18723	16		16		The row on droughts: Droughts are also caused by reduced precipitation, not due to increased ET alone. This is particularly true for subtropical land areas such as the Mediterranean, Australia and Southwest USA. This should be discussed here. [Govindasamy Bala, India]	Not applicable. Table removed from the SPM.
26033	16		16		In table SPM.1, the concept “atmospheric evaporative demand” should be explained (7th row and 2nd column) or referred to glossary. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
98013	17	1	17	1	<p>"Increase in tropical cyclone intensity (maximum surface wind speed)". Right column: "Medium confidence that the global increase [Which global increase? There are two increases in the middle column...] since the 1970s is not explained by natural variability...." I assume this refers to the increase in probability of exceeding Cat 3 or greater.</p> <p>Confidence level for detectable (unusual compared to natural variability) increase in proportion of stronger TCs should be low confidence. If IPCC allows split confidence levels, the authors could consider between low confidence and low-to-medium confidence. One can say medium confidence it has increased, but we don't really know why, and we don't have medium confidence that the increase is unusual compared to natural variability. Rationale: The conclusion that there is medium confidence that an increase in proportion of stronger TCs globally has become detectable is based on the likely increase in the proportion of stronger TCs globally over the past 40 years, and the statement that this is consistent with theoretical understanding and numerical simulations (citing Knutson et al. 2015, 2019b, and Walsh et al. 2015, 2016, Bender et al 2010 and Kossin et al. 2013). Also cited is the new Kossin et al. (2020) manuscript reporting the observed trend. None of these studies provide convincing evidence that the change reported by Kossin (2020) is outside the range of behavior expected from natural variability—which is what must be demonstrated for detection. This is different from finding that an observed change over some time period is similar to a modeled signal—one must still show that the change is highly unusual compared to natural variability, otherwise such agreement with a projection could be coincidental and not indicating detection. One way detection could be done is to compare the observed trend in the metric to a distribution of trends in climate model long control runs or large ensembles of natural forcing only runs. The modeled signals cited in the above papers are not comparable to the observed change in Cat 3-5 proportion in any case. Further, Bender et al. and Knutson et al. 2015, 2019b, and Walsh et al. 2015, 2016, Bender et al 2010 and Kossin et al. 2013).</p>	Not applicable. Table removed from the SPM.
10191	17	1	17	2	What about mid-latitude storms? [Robert Kopp, United States of America]	Not applicable. Table removed from the SPM.
15377	17	1	17	70	"poleward expansion of TC lifetime maximum intensity" is a bit inappropriate expression. Better to rephrase as "poleward migration of ..." or "poleward shift of ...". [Masaki Satoh, Japan]	Not applicable. Table removed from the SPM.
130025	17	1			<p>[CONFIDENCE] "Medium confidence that a reduction in anthropogenic aerosol forcing and volcanic eruptions has contributed substantially to the observed increase in North Atlantic tropical cyclone frequency since the 1970s." Change to "Medium confidence that anthropogenic aerosol forcing changes contributed to a suppression in North Atlantic tropical cyclone frequency during the 1950s and 60s and an increase since the 1970s." This is a better description of what aerosol forcing and volcanoes are believed to have done, based on Dunstone et al. and the new Murakami et al. paper (see their Supplemental Fig. S3 and also Fig. 2N). To refer only to the increasing part will mislead and confuse people. The models say the influence was more of a temporary dip caused by aerosols and volcanic eruptions. The models say the greenhouse gas influence was and will continue to be a negative trend. [Trigg Talley, United States of America]</p>	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130027	17	1			[CONFIDENCE] "Medium confidence that a reduction in anthropogenic aerosol forcing has contributed substantially to the observed increase in North Atlantic tropical cyclone intensity since the 1970s." This should be low confidence. Existing work (Dunstone et al., Murakami et al.) focuses on TC frequency, not intensity. Villarini and Vecchi looked at PDI, which conflates frequency, duration, intensity, and was not a dynamical model but statistical analysis. In all cases, the aerosol/volcanic influence is a temporary suppression, not just an increase since the 1970s. Since the studies don't even deal with intensity, this whole item should be deleted. [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.
130029	17	1			[CONFIDENCE] "Medium confidence for the migration in the western N. Pacific, based on a robust trend after regressing modes of inter-decadal variability from the time series, consistency with the independently-measured rate of tropical expansion and process understanding, and agreement with numerical models." Alter to say "some modes of inter-decadal variability". We don't have medium confidence that the change is unusual compared to natural variability. That is low or low-to-medium at the most. One can say medium confidence it has increased, but we don't really know why the increase has occurred, and we don't have medium confidence that the increase is unusual compared to natural variability. Rationale: The WMO TC/climate assessment (Knutson et al. 2019a) assessed this finding. The author team for that report expressed the following opinion on confidence levels (Table 1): low to medium confidence: 8 authors; medium confidence: 1 author; medium to high confidence: 2 authors. IPCC does not report distribution of opinion, but a single confidence level. This case study was discussed in detail in Knutson et al. 2019a, and there have been no new published findings on it since that assessment. The methodology of assessing how unusual the observed change is compared to natural variability consists of regressing out ENSO, PDO (or IPO), and the AMO, and examining trend of the residuals. This assumes that natural multidecadal variability in the metric is linearly related and well described by some combination of the predictors with little influence of any other process (e.g., atmospheric internal variability, coupled variability unrelated to the predictors) not included in the predictor list. The ability of these predictor variables to statistically describe the variability of the TC metric could be more thoroughly explored using climate model control runs which would give more confidence, though not complete confidence in this methodology. [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130031	17	1			[CONFIDENCE] "Medium confidence for the slowdown over the U.S., based on the length of record and a robust trend after regressing modes of inter-decadal variability from the time series." Alter to say "some modes of inter-decadal variability". We don't have medium confidence that the change is unusual compared to natural variability. That is low confidence. This would actually be a good candidate for a balance of evidence statement in the case of trying to avoid Type II errors as discussed by Knutson et al. (2019a), if IPCC were using that approach. In Knutson et al. (2019a), there was a balance of evidence/Type II error avoidance statement for detection of a global reduction in TC propagation speed, but that should now be dropped altogether for the global reduction, owing to the Comment and Reply in Nature on this topic (which was published too late for Knutson et al. to consider). Instead, recommend applying a similar balance of evidence/Type II error avoidance statement to the continental U.S. TC slowdown result since 1900 (detectable vs. not detectable). However, since IPCC is not using this Type II error/ balance of evidence approach, the recommendation that fits with their handling of confidence levels is just low confidence for the continental U.S. propagation speed decrease since 1901. A few related comments/questions on the continental U.S. slowdown finding follow, as this was not discussed in Knutson et al. (2019a). One of the difficulties with this type of analysis concerns how long the propagation speed of an individual tropical cyclone is tracked over U.S. land. At some point, the tropical cyclones may transition to extratropical cyclones. Is that when the propagation speed tracking is discontinued for that storm? In other words, what specific criterion was used to decide when to stop computing a propagation speed for a storm that would contribute to the annual mean value for a given year? Are we assured that the process of determining when a tropical cyclone is no longer a tropical cyclone is something which is homogeneous over time since 1900? It would be much harder to "make the call" on extratropical transition in 1900 than during the satellite era, even over land.	Not applicable. Table removed from the SPM.
130033	17	1			Referring to "Medium confidence that a reduction in anthropogenic aerosol forcing has contributed substantially to the observed increase in North Atlantic tropical cyclone intensity since the 1970s. Low confidence for direct role of greenhouse gas forcing." This comes from the relevant chapter, but is wholly incorrect. It is noted that the oceans have warmed more than 0.8°C, and most of that warming has occurred since the 1970s. It has been predominantly due to greenhouse gases. And that warming has occurred in all ocean basins, including the North Atlantic. So, somehow, the much less certain impact of aerosol reduction on the North Atlantic temperatures (much less certain because the temperature response from aerosols results primarily from uncertain aerosol/cloud interactions) provides more confidence in terms of its impact on N. Atlantic temperatures than the much more certain greenhouse gas warming of the ocean? [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.
131711	17	11	17	11	which temperature metric? Surface air? [Hans Poertner and WGII TSU, Germany]	Not applicable. Table removed from the SPM.
130035	17	38	17	45	[CONFIDENCE] Medium confidence seems too high for the slowdown in tropical cyclone translation speed over the United States. This statement appears to be largely based on the work of one author (https://www.nature.com/articles/s41586-019-1224-1), and has not been validated in subsequent studies. [Trigg Talley, United States of America]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25869	17		17		Concerning "Increase of tropical cyclone intensity", first column (Observed/detected trends), we highlight that the second paragraph (Medium confidence that the global probability of exceeding major intensity (Category 2 or greater) has increased since the late 1970s, based on homogenised data over the geostationary satellite period) does not appear in either Table 11.1 or TS7. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
25871	17		17		Concerning "Increase of tropical cyclone intensity", second column (Human contribution), we highlight that the first paragraph should be complemented with the words "with the exception of North Atlantic" as contained in the corresponding paragraphs in Table 11.1 and TS7. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
25873	17		17		Concerning "Increase of tropical cyclone intensity", second column (Human contribution), we highlight that its second paragraph (Medium confidence that the global increase since the 1970s is not explained by natural variability, based on agreement with theoretical expectations and robust support from numerical models under warming scenarios) does not appear in either Table 11.1 or TS7. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
25875	17		17		Concerning "Changes in frequency of tropical cyclones", second column (Human contribution), we highlight that the first paragraph should be complemented with the words "with the exception of North Atlantic" as contained in the corresponding paragraphs in Table 11.1 and TS7. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
25877	17		17		Regarding "Tropical cyclone track changes", we highlight that there is no reference to the fourth paragraph in column 1 (Observed/detected trends) and third paragraph of column 2 (Human contribution) in either Table 11.1 or TS 7. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
65565	17		17		Suggest reviewing the statements in the Table regarding TCs. There is at least one long-term trend where it can be argued that confidence is not low (landfalling Cat 3-5 tropical cyclones in NE Australia). This trend has strengthened and is now at 98% confidence level (Power and Callaghan 2020). [Kushla Munro, Australia]	Not applicable. Table removed from the SPM.
81507	17		17		In Table SPM.1: Recommend to revise 'Medium confidence that the global probability of exceeding major intensity (Category 3 or greater) has increased since the late 1970s, based on homogenised data over the geostationary satellite period.', as it is unclear. Alternatively, break it into 2 sentences, which deemed appropriate. [Ee Ling Lee, Malaysia]	Not applicable. Table removed from the SPM.
9623	17		17		severe convective storms: what trends? Is there a trend or not? Low confidence should be attached to a statement, here there is no clear statement. [Olivier Boucher, France]	Not applicable. Table removed from the SPM.
17471	17				The consistent Low confidence around Tropical Cyclones is striking. In some cases this is explained, e.g. due to data uncertainties but is further explanation justified? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
35273	17				Table SPM-1, second-last entry. We are not lacking good tornado data. The US has far more of these storms than anywhere else on earth owing to its geography and it has extremely good records back to the initiation of radar coverage. Numbers of all storms detected increased--thanks to the evolution of radar, not climate. There's no increase (maybe even a decrease) in severe tornadoes, F3 or higher, which would be indicative of some warming-related signal. But it's not there. [patrick Michaels, United States of America]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87457	18	1	18	1	influence' not 'influences' (top line of rightmost cell in table). [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
117191	18	1	18	1	In Table SPM.1 , last entry on "increase in compound events" it says Medium confidence that compound flooding risk has increased along the US coastline. My understanding of the new risk definition is that it only holds to human and ecosystems, so not to flooding for example! [Maisa Rojas, Chile]	Not applicable. Table removed from the SPM.
8141	18	1	18	1	Could this table also include an entry on concurrent events in different locations- which could be e.g. of importance for certain climate risks, commodities (e.g. from agriculture) etc., markets. I think there is literature that could be assessed. [Frank Dentener, Italy]	Not applicable. Table removed from the SPM.
10193	18	1	18	1	What about humid heatwaves? [Robert Kopp, United States of America]	Not applicable. Table removed from the SPM.
82535	18	1	18	3	It would be more appropriate to speak here of wildfire risk (which is climatically influenced), as Chapter 11 does, rather than wildfire occurrence - as Chapter 11 notes, wildfire occurrence at a global scale is decreasing as a result of non-climatic factors such as land-use change. This change would also remove an ambiguity in the attribution column, which is intended to reflect human influence on the climate but as currently worded would also include other human influences (e.g. number of human-caused ignitions). [Blair Trewin, Australia]	Not applicable. Table removed from the SPM.
40561	18	1	18	3	No mention of the term 'compound events' in the body of the SPM (it's only mentioned in tables). There is expanded coverage of this topic in the report compared to AR5, so should it be highlighted more in the SPM. [TSU WGI, France]	Not applicable. Table removed from the SPM.
108195	18	4	18	48	Box SPM.2 is intended to clarify issues related to "Scenarios and future climate system changes across timescales". Instead, it is presented in a very technical and frankly confusing manner to this target audience. A much clearer, more plain language approach must be taken, with supporting visuals. [Anton Holland, Canada]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. Figure SPM.4 has been redrafted to better and more comprehensively support the scenario introduction. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.
51991	18	15	18	18	The increase in stratospheric CO2 is also a major cause for warming and should be mentioned too here. Please see: Randel, W.J., Polvani, L., Wu, F., Kinnison, D.E., Zou, C.Z. and Mears, C., 2017. Troposphere-stratosphere temperature trends derived from satellite data compared with ensemble simulations from WACCM. Journal of Geophysical Research: Atmospheres, 122(18), pp.9651-9667. [Daniel Rosenfeld, Israel]	There is no line number 15-18 on p.18. It extends only to 3 lines. The table on p.15-18 has been moved to the TS and become two tables.
97283	18	18	18	19	Please provide examples of what this concurrent events affecting similar sectors could mean. In the TS (TS-58:56-57) the inclusion of the example of "breadbaskets" makes the potential implications very visible, helping policymakers to understand the relevance of concurrent events. [Nicole Wilke, Germany]	Accepted. Compound events is defined in footnote 10 and examples are provided.
50231	18	Table - last	18	Table - last	Table SPM.1: Should this row of the table (increase in compound events) be moved further up the table, as it has higher confidence statements than many of the rows above it (and this appears to be the ordering rationale)? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25879	18		18		Regarding "Increase in compound events" , first column (Observed/detected trends) , the sentence: "Medium confidence that human influence has increased wildfire occurrence in some regions." This probably refers to the human influence through climate change. However, anthropogenic activities contribute to the occurrence of wildfires through the introduction of ignitions, land use change and fire suppression (e.g., Abatzoglou, J. T., Balch, J. K., Bradley, B. A. and Kolden, C. A., 2018. Human-related ignitions concurrent with high winds promote large wildfires across the USA. International Journal of Wildland Fire, 27, 377–386. https://doi.org/10.1071/WF17149). These aspects of human influence on wildfires are not considered in the report. Therefore the sentence is confusing. Alternative writing: "Medium confidence that human influence on climate has increased wildfire occurrence in some regions." [Don Alfonso Pino Maeso, Spain]	Not applicable. Table removed from the SPM.
17473	18		18		Table SPM.1: As an example (this is a wider issue in this table), on this page the statement is made about compound flooding risk along the US coastline. This seems a very specific reference to one part of the world and there isn't a good global balance of examples. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the SPM.
26469	18		18		It is difficult to understand what is meant by "Medium confidence that human influence has increased wildfire occurrence in some regions" in the last row of the table - is the "human influence" related to that human actions are the reason behind climate change or to increased pyromaniac tendencies among various populations? [Mare Sundström, Sweden]	Not applicable. Table removed from the SPM.
131713	19	0			this box is long and complex. It does not provide clarity on the scenario relationship to the AR5 and the special reports (eg SROCC used RCPs, SRCCL also used SSP1, SSP2, SSP3), to allow comparisons among them. [Hans Poertner and WGII TSU, Germany]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. Figure SPM.4 has been redrafted to better and more comprehensively support the scenario introduction. We refrain from a detailed comparison with scenarios used in earlier IPCC reports in this SPM. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.
77593	19	1	9	28	Details on aerosols and their impact are not clear. Language is quite technical and could be revised for policy reader understanding. [Emer Griffin, Ireland]	Taken into account, figure SPM2c has been added in the final SPM to clarify the link between aerosol precursors and their effect on climate (through surface temperature change).
97285	19	1	20	6	We welcome the provision of a box regarding scenarios. We would however suggest to add information on the difference between the AR5 and the AR6 scenarios and the consequences of this change. There has been quite some criticism on RCP8.5 to be unrealistic, does this also hold for SSP5-8.5? How are the post-2100 emissions related to those used in the AR5 and the SROCC? We had assumed that the SSP do not include climate policy - yet the Box relates them to "incrementally stronger climate mitigation (SPM-19-29,30). Since this report often refers to the relevance of SLCF and air pollution control measures, it would be important to understand the assumptions within the scenarios assessed. In addition, it would be very useful to give the scenarios names that are easy to pronounce and easy to understand. [Nicole Wilke, Germany]	For sake of conciseness, it was not possible to add information about how SSPs compare with RCP in particular for air quality assumptions. However, Figure SPM2 show the trajectories for CH4 and on air pollutant (SO2) to illustrates the different trajectories for various compounds. More can be found in the technical summary which supports the content of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
15439	19	1	22	24	The reference periods of projections in AR5 and AR6 are 1986-2005 and 1995-2014 respectively. It is suggested to present the temperature change and global mean sea level change between these two reference periods in all tables in Box SPM.2 to facilitate comparison between AR5 and AR6 projections. [SAI MING LEE, China]	Rejected. This technical detail can be found in TS and Chapters.
104145	19	1	22	24	In Box SPM.2, a paragraph should dedicated to explain SSPs and their main assumptions, as it has been done in SRCCL. [Philippe Tulkens, Belgium]	Rejected, the narrative of the SSPs is beyond the scope of the WG1. This box which provides in the final version the key elements to understand the climate projections.
130037	19	1	22	24	Most of the information in Box SPM.2 is limited to 2100 or earlier. Any further information beyond 2100 would be helpful. For example, for each RCP, when must global CO2 emissions be reduced to zero to stabilize CO2 concentrations? This will occur after 2100 for some of the RCPs. This would help policymakers understand the longer term implications of each RCP. [Trigg Talley, United States of America]	Taken into account. Text and table have been simplified radically. Space constraints forbade including the detail requested here.
76847	19	1	22	25	SLCFs should be added to the discussion in this box. The Technical Summary pg9 l13-18 is a ueful example of how that SLCF dicussion could be included in Box SPM.2 [Nathan Borgford-Parnell, Switzerland]	For sake of conciseness, information about SLCFs remains short in the final Box SPM1 about scenarios. However, Figure SPM2 shows the trajectories for CH4 and on air pollutant (SO2) to illustrates the different trajectories for various compounds. More can be found in the technical summary which supports the content of the SPM.
42409	19	1	22	25	Complex box and table. Could it be made more simple? Why show 5 different SSPs /RCPs.Table SPM 3 holds similar (but not consitent info on remaining carbon budgets. [Tina Christensen, Denmark]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. Figure SPM.4 has been redrafted to better and more comprehensively support the scenario introduction. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.
90185	19	1	22	27	We consider that Box SPM.2 is much too long and too technical for an SPM and should be entirely deleted from the SPM and rather be included in the TS. It would be sufficient to refer to Box SPM.1 of the SRCCL, which contains the main messages on the Shared Socio-economic Pathways (SSPs) of current Box SPM.2 [Georges Gehl, Luxembourg]	Rejected, the Box SPM.1 of the SRCCL describes the narrative of the SSP scenario. This is not the aim of this box which provides in the final version the key elements to understand the climate projections.
12665	19	1	22	27	This box could introduce the narrative of SSP, so the policy makers can better understand the soci-ecomimy context behind these scenarios. [Lijing Cheng, China]	Rejected, the narrative of the SSPs is beyond the scope of the WG1.
86469	19	1	22	27	Box SPM2 is too detailed for SPM. This information belongs to the Technical summary that could be referenced here. A brief summary of scenarios would be sufficient. [Ala Taimar, Estonia]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. Figure SPM.4 has been redrafted to better and more comprehensively support the scenario introduction. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86113	19	4	19	4	Climate models are difficult to understand for non-climatologists, and yet it is very important basic information that all projections are based on. Every attempt should be made, even at the SPM level, to present this information in an accessible format, ideally visually, see for example https://www.carbonbrief.org/wp-content/uploads/2018/01/nclimate3398-f1.jpg and https://www.carbonbrief.org/wp-content/uploads/2018/01/parameterizations.png and https://www.carbonbrief.org/wp-content/uploads/2018/01/Evolution-of-climate-models-final.jpg What is special about CMIP6? How is it different from CMIP5? In plain English? Have the SSPs changed since AR5? How? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. Figure SPM.4 has been redrafted to better and more comprehensively support the scenario introduction. We refrain from a detailed comparison with models/scenarios used in earlier IPCC reports in this SPM. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4. Developments in climate models is discussed in Section 1.5.
69367	19	4	19	40	Adding detailed information on each SSP scenario (i.e., SSP1, SSP2, SSP3, and SSP5) would be useful for readers; what is SSP scenario, how it is constructed, and what kind of information is included in SSP scenario (e.g., land use change, socio-economic development, and emission of greenhouse gases)? Furthermore, adding detailed information on each SSPx-y scenarios (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5) to Box SPM.2 and Box SPM.2 Figure 1 would also be beneficial for readers, especially regarding the difference between SSPx-y in AR6 and RCPy in AR5 from the point of future greenhouse gas concentrations and/or radiative forcing. Or instead of adding the above sentences, indicate the more detailed reference, "Table T.3, Figure TS.9, Figure TS.10" would be another option. [Kaoru Magosaki, Japan]	The narrative of the SSPs is beyond the scope of the WG1. For sake of conciseness only a limited number of information about scenario can be provided here but all the elements supporting the conclusions summarized in the SPM are detailed in the technical summary.
11599	19	4	19	46	I assume it is a choice (maybe because of space constraints, or because the scenarios are not really a WG1 product) that the socio-economic pathways (the x in sspX-Y) are not explained? It could be a bit frustrating, for example, to read that ssp3-70 "is also considered an unmitigated baseline scenario" without being given a short explanation what the difference is between ssp3 and ssp5 (fragmentation vs. development first). [Gerhard Krinner, France]	Rejected, the narrative of the SSPs is beyond the scope of the WG1.
114931	19	4	20	6	Please point to the fact that a much larger set of emissions scenarios is assessed in WG3 AR6. Due to quasi-linear relationship between CO2 warming and cumulative CO2 emissions, there is no path dependency in this component of the warming response to CO2 emissions, and consequently the larger variation in emissions profiles as assessed by WG3 is not consequential for the temperature ranges estimated in Table 1 as long as the same range of cumulative CO2 emissions is covered. However, and this is the important part to note, this is not true for non-CO2 warming much of which depends on the time profile of SLCF emissions, which can vary greatly between the scenarios assessed in WG3, even between those with similar cumulative CO2 emissions. This introduces path dependency to the overall warming signal. Hence, the ranges presented in Table 1 hinge on a particular choice of non-CO2 emissions in the given scenario which is not the median, not even representative, of the range of non-CO2 emissions profiles associated with RCP1.9, 2.6, ... etc. scenarios. I think it is important to raise this important caveat. [Elmar Kriegler, Germany]	Noted. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89825	19	4	22	24	Sutton & Hawkins (ESD, 2020) argue that this report could usefully consider climate response scenarios as well as socio-economic scenarios. (see: https://www.earth-syst-dynam-discuss.net/esd-2019-88/) [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Noted. No change requested.
50239	19	4	22	25	Suggest here there it is highlighted that that questions of economic/technical/feasibility are not covered in WG1 and the reader should refer to WG3. Suggest also including a clearer statement at the start of the box that the small number of scenarios considered does not represent all futures (currently not mentioned until section C). Suggest the box also mentions overshoot. The mention of path independence and carbon budgets - this is temperature focused and doesn't highlight aspects that do depend on path, such as sea-level rise - suggest these aspects are acknowledged here also. In the table of temperature results please also include a magnitude relative to pre-industrial – at present this is covered indirectly through timing of 1.5C, 2C etc. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, a footnote (22 in the final SPM) clarifies that the scenario plausibility is not covered by the WG1 assessment. The Table SPM1 provide the Temperature results relative to preindustrial.
68229	19	4	22	25	Add SLCFs to this discussion, similar to what is covered in the Technical Summary: TS-9, L13–18 (“The Special Report on Global Warming of 1.5°C (SR1.5) report concluded that achieving Paris Agreement goals, including limiting warming to 1.5°C, would require simultaneous and ambitious reductions of SLCFs and long-lived GHGs within the next decades. However, except for methane and halogenated species, regulations of SLCF emissions have so far been decided independently from climate policies. A dedicated set of policies developed with a focus on co-benefit solutions would be required to maximize climate mitigation and air quality improvements. {TS3.6, 6.5, Box 6.2, FAQ 6.2}”). The current draft of Chapter 6 does specify the contributions of O3, CH4, and HFCs will have in the near future (until 2040), but the quantification of each of those is not provided and would be helpful for policymakers looking to make policies for mitigation in sector-specific emissions. Similarly, aerosols are lumped together, and this is another instance where distinction would be useful between the cooling versus warming aerosols (sulfates versus black carbon, for example). [Durwood Zaelke, United States of America]	Not applicable, this is treated elsewhere in the SPM (actually D1.7 and D2.2 in the final SPM).
66725	19	4	22	25	Add SLCFs to this discussion, similar to what is covered in the Technical Summary: TS-9, L13–18 (“The Special Report on Global Warming of 1.5°C (SR1.5) report concluded that achieving Paris Agreement goals, including limiting warming to 1.5°C, would require simultaneous and ambitious reductions of SLCFs and long-lived GHGs within the next decades. However, except for methane and halogenated species, regulations of SLCF emissions have so far been decided independently from climate policies. A dedicated set of policies developed with a focus on co-benefit solutions would be required to maximize climate mitigation and air quality improvements. {TS3.6, 6.5, Box 6.2, FAQ 6.2}”). [Kristin Campbell, United States of America]	Not applicable, this is treated elsewhere in the SPM (actually D1.7 and D2.2 in the final SPM).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69845	19	4	22	25	This discussion should also consider SLCFs, as covered in the technical summary TS-9, L13–18 (“The Special Report on Global Warming of 1.5°C (SR1.5) report concluded that achieving Paris Agreement goals, including limiting warming to 1.5°C, would require simultaneous and ambitious reductions of SLCFs and long-lived GHGs within the next decades. However, except for methane and halogenated species, regulations of SLCF emissions have so far been decided independently from climate policies. A dedicated set of policies developed with a focus on co-benefit solutions would be required to maximize climate mitigation and air quality improvements. {TS3.6, 6.5, Box 6.2, FAQ 6.2}”). [Gabrielle Dreyfus, United States of America]	Not applicable, this is treated elsewhere in the SPM (actually D1.7 and D2.2 in the final SPM).
69851	19	4	22	25	Include discussion of table showing differences in climate extremes over land for each scenario in each time period, as discussed in 4-76 L 29-44 and Chapter 11. [Gabrielle Dreyfus, United States of America]	Rejected. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Results on projections of climate extremes as presented in section B and C of the SPM.
34417	19	4			Projections of GSAT appear to be higher for 3 pathways comparable to the AR5 RCPs. For example, Table 1 has T rise (above that in 1850-1900) in the last 20 years of this century is about 0.3C higher than that of the AR5 RCPs 2.6, 4.5, and 8.5. This seems like a notable finding that would be important to explain why these comparable scenarios have warmer outcomes. [Haroon Kheshgi, United States of America]	Noted. Former Box 2, table 1 removed from new Box SPM.1. Note that the SSP-RCP scenarios used in AR6 are not identical to the corresponding RCPs used in AR5. There is a difference in the mix of radiative forcings. The differences are assessed in Chapter 4 Fig.4.35 and related text. We refrain from adding that level of detail here in the SPM due to space constraints. Key projection results are presented in Section B "our possible climate futures".
37505	19	6	19	10	You are assuming and asserting that GHG's etc change climate but thus far in the SPM you have shown no evidence whatsoever to support such a claim. This sentence should be placed after showing such evidence, if you have any. [John McLean, Australia]	Rejected. The SPM is the top level document of a comprehensive assessment of the scientific literature on climate change. It draws from the underlying chapter assessments. Traceability is ensured through the lines of sight provided at the end of each statement, figure and table caption.
112157	19	6	19	11	It may be necessary to make a statement here (or somewhere else) about the potential implications of the COVID-19 pandemic for the validity of the SSPs and of the reference data and trends used in defining the socioeconomic scenarios. Observations of emissions and of GHG concentrations have also shown effects of the global lockdown, albeit relatively minor ones. It would be important to point out, I think, that although the pandemic is having global economic impacts that are currently tangible and also influencing some radiative forcing agents as well as affecting global exposure and vulnerability to climatic impact-drivers, these fluctuations in a few key driving variables are likely (unless they induce major bifurcations) to be regarded as minor anomalies in the long-term context of the scenarios. Such events are commonly regarded as wild card scenarios that are often used to test the robustness of longer-term scenario outcomes. There are several examples of wild card scenarios for global pandemics in the literature, some of those applied in conjunction with long-term climatic impact-drivers, so for scenario analysts, at least, the current situation is not unanticipated (at least, in theory). [Timothy Carter, Finland]	Taken into account, a summary of the effects of the measures to reduce spread of COVID-19 is given in the final version of the SPM (D2.1).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131715	19	7	19	7	The term "anthropogenic forcing" is very technical and might not be clear for everyone. Consider explaining or using something like "human influence" [Hans Poertner and WGII TSU, Germany]	Taken into account. Text revised accordingly. Human influence is favoured in the revised SPM and is defined in the introduction (footnote 4).
44759	19	7	19	7	What does the "other anthropogenic forcings" refer to? [Markku Rummukainen , Sweden]	Not applicable. Text deleted.
87183	19	7	19	9	In a box about scenarios one would perhaps expect an explanation of how such scenarios are developed. The sentence 'generated by internally consistent assumptions about socio-economic systems changing over the 21st C' is neither very easy to understand for a non-expert reader or sufficient for the readers who seek to understand better how the scenarios are developed. Please consider expanding with one or two sentences here. [Oyvind Christophersen, Norway]	Noted. But we refrain from adding more details on the scenario development for mostly space limitation. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
50233	19	9	19	9	Suggested edit: ' Emissions from natural sources are assumed to be either constant or evolve in response to changes in anthropogenic forcings...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""
36147	19	9			The idea that natural sources are constant without human or climate changes is not correct. There is internal climate variability and that can certainly change natural sources (eg, ENSO). Fix this, or admit it is an arbitrary assumption in the scenarios. This is a long-standing problem with the scenarios since the SAR SRES where we had to come up with consistent non-anthrop emissions in order to do the projections. And, Yes, since we had no information, we assumed they were constant. [Michael PRATHER, United States of America]	Taken into account. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""
131717	19	10	19	10	The term "natural forcing" is very technical and might not be clear for everyone. Consider explaining [Hans Poertner and WGII TSU, Germany]	Not applicable. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""
65567	19	10	19	11	Suggest clarification by removing the statement "Natural forcings such as changes in solar irradiance and volcanic eruptions are also explicitly taken into account", since past simulations do, but projections don't. [Kushla Munro, Australia]	Taken into account. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""
53487	19	10	19	11	may be misleading and suggesting that future volcanic eruptions can be anticipated? [Hervé Douville, France]	Taken into account. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""
44761	19	11	19	11	Are volcanic eruptions explicitly accounted for in projections, as a rule? If not, some rewording or shorter text would be useful here to avoid misunderstanding. [Markku Rummukainen , Sweden]	Taken into account. Text in new Box SPM.1 deleted. Instead, the introduction to the second section (Our possible climate futures) states "These projections also account for solar activity and long-term background forcing from volcanoes""

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34989	19	13	19	40	The suite of CMIP6 climate models in the SOD includes SSP8.5. This high emissions scenario implies a CO2 level of up to 1000ppm by 2100, which is totally unrealistic. See comment #2 above. [Jim O'Brien, Ireland]	Noted. New Box SPM.1 explicitly states that "This Report focuses on the climate response to this set of scenarios, whereas the feasibility or likelihood of individual scenarios is not part of the assessment." Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
17581	19	13		32	With ref to Hausfather-Jones article in Nature jan 2020, scenario SSP5-8,5 should be explicitly classified as an implausible worst-case scenario to avoid confusion with "business-as-usual" or "no climate policy implemented". Some extra explanation of the issues mentioned in that article is highly desirable, because many experts including climate researchers and policymakers and media have used RCP8.5 as the business-as-usual case. The business as usual story is strongly misleading and should be corrected and clarified to avoid confusion. [ferdinand meeus, Belgium]	Noted. New Box SPM.1 explicitly states that "This Report focuses on the climate response to this set of scenarios, whereas the feasibility or likelihood of individual scenarios is not part of the assessment." Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
27879	19	14	19	14	More information on the SSPs, in particular regarding their likelihood or realism, would be welcomed. [Eric Brun, France]	Noted. New Box SPM.1 explicitly states that "This Report focuses on the climate response to this set of scenarios, whereas the feasibility or likelihood of individual scenarios is not part of the assessment." Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
84709	19	14	19	15	not only ESM are considered among CMIP6 coupled models [Annalisa Cherchi, Italy]	Taken into account. Text revised accordingly. Box SPM.1 now refers to "the latest generation of global climate models coordinated by the Coupled Model Intercomparison Project Phase 6"
8143	19	14	19	17	For ease of recognition, I recommend to introduce here the characteristic labelling of the SSPs- e.g. regional rivalry- middle of the road. Even having seen this a long time, it is still quite difficult to 'place' SSP1, ... SSP5 on a mental map. [Frank Dentener, Italy]	Rejected. We deliberately refrain from introducing the underlying socioeconomic pathways of the SSPs in the SPM. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Detailed information on the set of illustrative scenarios considered in the WGI report, the underlying SSPs etc., is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
104147	19	14	19	17	For ease of recognition, suggest introducing here the characteristic labelling of the SSPs- e.g. regional rivalry- middle of the road. Even having seen this a long time, it is still quite difficult to 'place' SSP1, ... SSP5 on a mental map. [Philippe Tulkens, Belgium]	Rejected. We deliberately refrain from introducing the underlying socioeconomic pathways of the SSPs in the SPM. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Detailed information on the set of illustrative scenarios considered in the WGI report, the underlying SSPs etc., is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50505	19	14	19	24	The SSPs are referred to on line 14 as "emission scenarios" but this does not reflect how they are used in the CMIP6 projections used in this report. The scenarios are defined with approximate radiative forcings (as explained in footnote 9 on this page) and involve GHGs specified as concentrations not emissions. This is an important point because AR5 WG1 showed that there is a wide range of CO2 emissions scenarios compatible with any particular concentration pathway, and chapter 5 in this volume still shows substantial uncertainties in climate-carbon cycle feedbacks. Hence referring to the SSPs as emission scenarios is confusing and leads to misunderstandings. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. No action for space constraints and because we don't agree that this is crucial information at the level of the SPM. Detailed information on the set of illustrative scenarios considered in the WGI report and the difference between emission vs. concentration-driven simulations is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
109507	19	14	19	24	This discussion needs to clarify the difference between emissions scenarios and the pathways of CO2 concentrations. Chapter 4, Box SPM.2 and Figure 7 show projections from CMIP6 simulations which are driven CO2 concentrations not emissions, and there is uncertainty in relating emissions scenarios and concentration pathways due to uncertainties in carbon cycle feedbacks. [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. No action for space constraints and because we don't agree that this is crucial information at the level of the SPM. Detailed information on the set of illustrative scenarios considered in the WGI report and the difference between emission vs. concentration-driven simulations is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
97287	19	14	19	25	Box SPM.2: What is the difference between SSP and RCP for identical radiative forcings, e.g. SSP5-8.5 versus RCP8.5? [Nicole Wilke, Germany]	Noted. No action for space constraints. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
9649	19	14	19	32	More information on the SSPs, in particular regarding their likelihood or realism, would be welcomed. [Olivier Boucher, France]	Noted. New Box SPM.1 explicitly states that "This Report focuses on the climate response to this set of scenarios, whereas the feasibility or likelihood of individual scenarios is not part of the assessment." Detailed information on the set of illustrative scenarios considered in the WGI report is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4; reference to the WGIII report is made there.
78275	19	15	19	21	Understand that the new SSP scenarios and the old RCPs are both labelled by the level of radiative forcing they reach in 2100, they can be directly related to each other. It would be helpful to have more explanatory notes on how RCPs and SSPs are meant to be complementary, how they relate to each other and how can we compare between AR6 and prior reports (e.g. RCP6.0 vs SSP3-7.0, SSP1-1.9 is a new scenario?) [Leonie Lee, Singapore]	Noted. No action for space constraints. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
104149	19	16	19	17	Mention in the footnote the metric for radiative forcing. [Philippe Tulkens, Belgium]	Taken into account. Unit added (W/m2).
101563	19	16			Change "five scenarios illustrate a range of possible" to "five Shared Socio-Economic Pathway scenarios (SSPs) illustrate a range of possible" [Knut Nadelhoffer, United States of America]	Rejected. Text was revised to "These scenarios span a broader range of greenhouse gas and air pollutant futures than assessed in earlier WGI reports."
11593	19	17	19	18	"... spans a range... that, at its lower end, is wider than..." With a bit of bad wil or bad luck, this can be misunderstood. Maybe "... spans a range... that, extended at its lower end, is wider than..." would be clearer. [Gerhard Krinner, France]	Not applicable. Text shortened and revised, focusing on the emission pathways in absolute terms (low-high).
27881	19	17	19	18	The wording should be simpler here. Cut the sentence in two sentences to be more explicit for a larger audience? [Eric Brun, France]	Not applicable. Text shortened and revised, focusing on the emission pathways in absolute terms (low-high).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
80103	19	17	19	21	Missing from here why RCPs are similar to SSPs and how can they be intercompared or complement each other. Wider in what measure: the caused global temperature change, the emission they are based on or the caused radiative forcing? It is mentioned here that there were too few CMIP6 simulations but they are complemented with the CMIP5 simulations applying RCPs or the CMIP6 applied both the RCPs and the SSPs? What about the emulators to complement the simulations? It is mentioned later in this box. [Lilian Fejes, Hungary]	Noted. New Box SPM.1 has been refocused and shortened, now focusing on introducing the set of illustrative scenarios consistently used across the WGI report and climate model developments. Results on projections of climate extremes as presented in section B and C of the SPM. Detailed information on the set of illustrative scenarios considered in the WGI report, the underlying SSPs etc., is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.
36149	19	17			this phrasing "at lower end,... wider than.." is hard to read correctly, try simple comparison with RCPs. [Michael PRATHER, United States of America]	Not applicable. Text shortened and revised, focusing on the emission pathways in absolute terms (low-high).
131719	19	18	19	18	specify how larger, eg indicate the 'new' radiative forcing levels or give the AR5 range [Hans Poertner and WGII TSU, Germany]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
17475	19	18	19	20	In this report, the RCPs complement the core set... or for comparison to earlier IPCC reports.' The meaning of this is unclear to a non-specialist. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text shortened and revised, focusing on the emission pathways in absolute terms (low-high).
110991	19	18	19	20	In this report, the RCPs complement the core set... or for comparison to earlier IPCC reports.' The meaning of this is unclear to a non-specialist. [Monica Dean, United States of America]	Not applicable. Text shortened and revised, focusing on the emission pathways in absolute terms (low-high).
34529	19	18	19	24	Since the SSPs are the core of AR6, it seems more intuitive to fully describe them first, then describe the RCPs and their supplemental role. In its current form, the text jumps from SSPs to RCPs and then back to basic information about SSPs. [Russell Vose, United States of America]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
50235	19	19	19	19	In this report, the RCPs complement the core set of AR6 scenarios for assessments where no CMIP6-based results are available or for comparison to earlier IPCC reports.' Is this supposed to be AR5 scenarios? I'm not sure I understand this sentence otherwise. Also, is this referring to RF or socioeconomic scenarios, or both? Please could you clarify this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
11595	19	19	19	19	"assessments where" Maybe better: "assessments for which"? [Gerhard Krinner, France]	Not applicable. Text shortened and revised.
65569	19	20	19	21	Suggest clarification as the RCPs are also labelled by the level of radiative forcing they reach in 2100, they can be directly related to the core set of AR6 scenarios. [Kushla Munro, Australia]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
44909	19	20	19	21	The "Since the RCPs are also labelled by the level of radiative forcing they reach in 2100, they can be directly related to the core set of AR6 scenarios." is not accurate. There are significant differences in the RCP and the AR6 forcing, see e.g. Wyser et al. 2020 Environ. Res. Lett.15 054020. [Markku Rummukainen, Sweden]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
11399	19	20	19	21	Since the RCPs are also labelled by the level of radiative forcing they reach in 2100, they can be directly related to the core set of AR6 scenarios.” Not true. It turns out that there are differences in the RCP forcing and in the AR6 forcing that significantly impacts the simulated climate, e.g. Klaus Wyser et al 2020 Environ. Res. Lett.15 054020. This is also what’s stated in Box 1.3 [Strandberg Gustav, Sweden]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
107991	19	21	19	21	SSPx-y does not have the same transient forcing as RCPy, as far as I understand, so it may be confusing to say they are "directly related". Perhaps remove "directly"? [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
46569	19	21	19	21	I disagree that RCPs can be directly related to SSPs even for same radiative forcing. For example, RCP8.5 has higher CO2 concentration and lower methane concentration in 2100 than SSP5-8.5, which might cause substantial differences in modeled climate response despite identical implied forcing. [Dirk Notz, Germany]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
81649	19	21	19	21	It is my understanding that the radiative forcing in the SSPs may not be directly comparable to that in the RCPs, so this statement needs softening or a caveat - reference: Nicholls et al. 2020 Reduced complexity model intercomparison project phase 1: Protocol, results and initial observations. Geoscientific Model Development Discussions, https://doi.org/10.5194/gmd-2019-375 [Michael Grose, Australia]	Not applicable. RCP comparison removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and comparison to scenarios used in earlier reports is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
11597	19	22	19	22	"simple idealized": Could perhaps be misunderstood as carrying a value judgment. Maybe just say "simplified"? [Gerhard Krinner, France]	Not applicable. Text removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and their extensions beyond 2100 is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
112159	19	22	19	40	It might be worth pointing out that these air pollution scenario forcings may differ substantially for a given radiative forcing level from those assumed in AR5 RCP-based forcings. [Timothy Carter, Finland]	For sake of conciseness, it was not possible to add information about how SSPs compare with RCP in particular for air quality assumptions. However, Figure SPM2 show the trajectories for CH4 and on air pollutant (SO2) to illustrates the different trajectories for various compounds. More can be found in the technical summary which supports the content of the SPM.
51993	19	23	19	23	I suggest adding "few" before "decades". [Daniel Rosenfeld, Israel]	Not applicable. Text on page 19, line 23 does not include "decades"...unclear what this comment refers to.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27883	19	23	19	23	It should be made clear somewhere that global pathways SSPs in terms of forcing agents and that relative forcing of the different forcing agents are not simply related. This can have global impact, but the underlying assumptions are more important at the regional scale. Also it should be mentioned that for a given RCP, several combinations of forcing agent are possible and that the simulations only refer to one of these possible pathways for a RCP level. Model results are highly dependent on the assumptions and they should not be forgotten. [Eric Brun, France]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. However, we refrain from providing more detailed discussions and explanations of the SSP scenarios (choices) in the SPM given the limited space and the focus on the physical climate outcome from scenario-based climate projections. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.
64795	19	26	19	26	The word "initially" implies the design of SSP1-1.9 may now function differently than designed but it is not clear here. As written, it seems to imply SSP1-1.9 no longer represents a possible climate future below 1.5 °C. Consider clarification. [Casey Kopcho, United States of America]	Not applicable. Text removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and their extensions beyond 2100 is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
17479	19	26	19	28	Can it/should it be stated that RCP8.5 is considered 'unlikely' given global actions taken to date? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	The assessment of plausibility and feasibility of scenarios is beyond the scope of WG1. It is now clearly stated in the first paragraph of the BOX SPM1 of the final version.
50507	19	26	19	28	It should be noted that the CO2 concentrations in SSP5-8.5 could also result from a lower emissions scenario if climate-carbon cycle feedbacks are strong, see for example Booth et al (2017) Narrowing the Range of Future Climate Projections Using Historical Observations of Atmospheric CO2, J. Climate 30, 3039-3053 https://doi.org/10.1175/JCLI-D-16-0178.1 [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the final version of FGD mentions that alternative assumptions may result in similar emissions in the first paragraph of Box SPM1.
130039	19	26	19	40	[ENSEMBLES] It is stated that SSP5-8.5 represents the scenario where no climate policy is implemented, but then later states that control of air pollutants and methane emissions are curbed for this scenario. This warrants additional explanation. It is better explained in the Technical Summary, but the different SSPs need to be explained more thoroughly here as well. [Trigg Talley, United States of America]	The SSP5-8.5 is a scenario without climate policy but the narrative is based on a peak and decline in population. The sum of hypothesis used to build this scenario lead to a decrease of CO2 and CH4 emissions in the second half of the 21st century. The description of the narrative and the evolution of the detailed hypothesis is beyond the scope of WG1. However, a more thorough explanation of the SSP is given in the technical summary and in chapter 1.
111791	19	27	19	27	On RCP8.5.: to highlight that "no policy" doesn't mean BAU it would be preferable to add a directional qualifier, like "with no climate policy implemented anymore" or "with climate policy dismantled/abolished etc." [Oliver Geden, Germany]	Not applicable. Text removed from new Box SPM.1. Detailed information on the set of illustrative scenarios considered in the WGI report and their extensions beyond 2100 is provided in section TS1.3.1, and in particular in Section 1.6.1 and Cross-chapter Box 1.4
130041	19	27	19	27	[ENSEMBLES] In describing SSP5-8.5, the authors should take care NOT to call it a "no climate policy" scenario. In fact, it does reflect some semblance of the current state of affairs as a starting point, right? And there IS climate policy in effect around the world. If -- and it should be stressed, if -- SSP5-8.5 explicitly assumes no ADDITIONAL climate policies are enacted, then the text should be revised to say "...no ADDITIONAL climate policies implemented..." [Trigg Talley, United States of America]	Not applicable. Text removed from new Box SPM.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7687	19	28	19	28	It is suggested to substitute "of" by "on". [Klaus Radunsky, Austria]	Not applicable. Text removed from new Box SPM.1.
51995	19	28	19	29	GMSL was higher than present during the previous intrglacial. The wording might be interpreted as otherwise. I suggest to modify the wording to "since the ending of the last interglacial". [Daniel Rosenfeld, Israel]	Not applicable. Text on page 19, line 23 does not discuss GMSL...unclear what this comment refers to.
44763	19	28	19	29	Suggest "... is also an unmitigated scenario, but on a lower level than RCP8.5 as... [and please provide the reason why the scenario is "lower"]. In addition, using "baseline" may be misleading, as 8.5 is not necessarily a baseline in a real-world sense, or a very realistic BaU either. [Markku Rummukainen , Sweden]	Not applicable. Text removed from new Box SPM.1.
112155	19	29	19	29	The term baseline is used here in a different sense than it is used elsewhere in the WG I report. Here it refers to a reference trend in radiative forcing into the future (without mitigation policy), which is common WG III useage. Elsewhere in WG I, baseline refers to a reference period typically representing the recent past or some historical period such as the pre-industrial period. Perhaps that distinction needs to be pointed out here, or perhaps another term used. [Timothy Carter, Finland]	Not applicable. Text removed from new Box SPM.1.
65571	19	29	19	30	Suggest clarification. It is odd that none of the scenarios seem to specifically address the target in the Paris Agreement of "well below 2C" (and by implication above 1.5C). [Kushla Munro, Australia]	Not applicable. Text removed from new Box SPM.1.
80105	19	33	19	35	It could be not perfectly clear for the user why the SSP5-8.5 scenario is controlled regarding air pollution if there is no climate policy (see above paragraph in text). [Lilian Fejes, Hungary]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
54649	19	33	19	40	Recommend separating out the discussion of SSP5-8.5 in this para from that related to SSP1-1.9 and SSP1-2.6. SSP5-8.5 has no climate mitigation policy therefore describing changes in air pollutant concentrations from both air pollution controls AND climate change mitigation for the three scenarios together is confusing. Presumably air pollution controls in SSP5-8.5 involve mainly end-of-pipe solutions as this scenario is still heavily reliant on coal and other fossil fuels whereas in the other scenarios, decarbonization will contribute strongly to reductions in air pollutants. [Nancy Hamzawi, Canada]	The assumption behind the SSPs are not chosen by WG1. The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
8145	19	33	19	40	Maybe useful to explain (like the consistency with SSP storylines), how air pollution assumptions map to the labels 2.6...8.5; as they will obviously influence the forcing. [Frank Dentener, Italy]	The assumption behind the SSPs are not chosen by WG1. The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
131987	19	33		40	The consideration of air pollution scenarios among SSPs appears arbitrary, a rationale is not visible. [Hans Poertner and WGII TSU, Germany]	The assumption behind the SSPs are not chosen by WG1. The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
10195	19	34	19	34	Do the socio-economic narratives need to be explained? [Robert Kopp, United States of America]	SSP narratives are beyond the scope of WG1.
25881	19	34	19	35	Is control of air pollutants considered to be strong in SSP5-8.5 scenario? This is not evident from the definition of this scenario (Chapter 1,Box 1.3, Table 1, page 98). [Don Alfonso Pino Maeso, Spain]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130043	19	34	19	38	[ENSEMBLES] The references to SSP5-8.5 are misplaced in two sentences. The first sentence in lines 34-35 reads: "Control of air pollutants is considered to be strong in SSP1-1.9, SSP1-2.6 and 35 SSP5-8.5 scenarios, medium in SSP2-4.5 and weak in SSP3-7.0." The sentence should read: "Control of air pollutants is considered to be strong in SSP1-1.9, SSP1-2.6 scenarios, medium in SSP2-4.5 and weak in SSP3-7.0 and SSP5-8.5." It is also misplaced in the following sentence in lines 35-38: "Combined with climate change mitigation measures, these air pollution controls are projected to lead to a strong decline of ozone precursor and aerosol emissions in the mid (2041-2060) to long term (2081-2100) in SSP1-1.9, SSP1-2.6 and SSP5-8.5, while they would follow current trends in SSP2-4.5, and see strong increases over the 21st century in SSP3-7.0." This sentence should read: "Combined with climate change mitigation measures, these air pollution controls are projected to lead to a strong decline of ozone precursor and aerosol emissions in the mid (2041-2060) to long term (2081-2100) in SSP1-1.9 and SSP1-2.6, while they would follow current trends in SSP2-4.5, and see strong increases over the 21st century in SSP3-7.0 and SSP5-8.5." Since SSP-8.5 represents "the high end of the range of future pathways in the literature, with no climate policy implemented and a high reliance of carbon-intensive energy sources," ozone precursor and aerosol emissions would be expected to continue increasing, not to decrease. [Trigg Talley, United States of America]	Rejected, the comment is wrong. Even if it can appear counterintuitive, the SSP5 scenario sees a decline in emissions of most of the air pollutant precursors (see Figure SPM4 in the final SPM and Figure 6.18 in chapter 6) because strong air pollution control is considered even in the absence of climate change mitigation. This is because air pollution control level results directly from the narrative which, for SSP5, includes the successful management of local environmental problems like air pollution despite a development bases on fossil fuel. This is explained in the Technical summary which supports all the conclusions presented in the SPM and in more details in chapter 6.
27885	19	34	19	40	This is not clear why SSP5-8.5 scenario is characterized in the same group as SSP1-1.9 and SSP1-2.6 scenarios regarding control of air pollutants, though SSP5-8.5 is characterized by a high reliance of carbon-intensive energy sources. [Eric Brun, France]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
50237	19	35	19	35	RCP8.5: so a high RF value arises because of a combination of high fossil fuels but also aerosol reduction under this scenario - so more aerosols would have reduced the RF response? Suggest a clear explanation is provided on the impact of aerosols emissions reductions in addition to the description of the trends. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
29411	19	35	19	35	It is unclear why there is strong air pollutant control in the SSP5-8.5 scenario [Joachim Fallmann, Germany]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusion presented in the SPM.
7691	19	35	19	40	It is suggested to provide some explanation for the assumptions with respect to the future development of emissions of air pollutants under the various scenarios; such explanation would be helpful in particular for the assumption that under SSP5-8.5 there is a strong decline of ozone precursor and aerosol emissions in the mid (2041–2060) to long term (2081–2100) as under SSP1-1.9, SSP1-2.6 given that use of fossil fuel would continue under SSP5-8.5 and this is also a significant source of air pollutants. [Klaus Radunsky, Austria]	The rationale behind air pollution control results directly from the narrative. This is explained in the Technical summary which supports all the conclusions presented in the SPM.
17477	19	36			ozone precursor emissions' should probably be defined on first use. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	The meaning of precursors is clarified thanks to the visual of figure SPM2c.
50241	19	38	19	38	'...current trends in SSP2-4.5' - please could you specify if the direction of trends for ozone precursor and aerosol emissions, are they declining or increasing? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, the trends are not described anymore in the final SPM version.
27887	19	39	19	39	Land use is also a factor affecting the different pathways, something should be mentioned about it and the way it is considered. [Eric Brun, France]	Taken into account. Land-use patterns are explicitly referred to in new Box SPM.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44765	19	39	19	40	As also the 4.5 and 7.0 are discussed in this box, they could be added to here as well. [Markku Rummukainen, Sweden]	No applicable, evolution of CH4 emissions are now shown in the final version of the SPM on Figure SPM4.
51997	19	41	19	41	It is not clear what period is meant by "the mid 2000s"? [Daniel Rosenfeld, Israel]	Noted. Unclear what this refers to.
80107	19	43	19	43	Reference time period is normally the period we compare the changes with regard, we suggest using 21st century time slices instead. [Lilian Fejes, Hungary]	Accepted and modified.
12663	19	45	19	45	It is better to design SPM-Fig.7 similar to SPM-Fig.1, to show correspondence between past and future changes. [Lijing Cheng, China]	Taken into account. Figures have been redesigned.
81835	19	45			"key variables shown in Figure SPM.7" [not SPMC Figure 7] [Dan Zwart, New Zealand]	Accepted and modified.
7693	19	48	19	48	Information related to future projections as a function of the time selected global warming levels are reached is very much appreciated and should be kept. [Klaus Radunsky, Austria]	Noted.
15379	19	48	19	48	"SPM BOX.2 Figure 1": The reference to the figure is ambiguous: need to change "BOX SPM.2, Figure 1". [Masaki Satoh, Japan]	Accepted and modified.
50509	19	48	19	48	The use of "global warming levels" as done here is supported. Elsewhere in the report, "temperature levels" is sometimes used, but that is potentially misleading. Global warming levels clarifies that 1.5C, 2C etc refer to changes in temperature rather than absolute temperature, and also make clear that these numbers only really have policy relevance when applied to global means (as opposed to regional means). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
29413	19	48	19	48	correct: Box SPM.2 [Joachim Fallmann, Germany]	Accepted and modified.
80109	19	48	19	48	SPM Box.2 Figure 1 is not about what the text claims it is but about the temperature signal and emissions as a function of the scenarios. Could be corrected. [Lilian Fejes, Hungary]	Taken into account. Text and table have been simplified radically.
77709	19		22		Box SPM2 describes future emission scenarios and details future projections. Would this Box not be better suited in Section C 'Our possible climate futures' instead of Section B 'The current state of the climate: where are we now and how did we get here?' [Emer Griffin, Ireland]	Not applicable. Structure of the SPM significantly revised.
81217	19			22	3 tables in Box SPM.2 with too many values do not help capturing the main messages [Fatima Driouech, Morocco]	Accepted. There is only Box SPM.2, table 1 that was retained and shortened in the revised draft.
15039	20	0	22		These tables have too much information for the summary and should be relegated to the main report. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. There is only Box SPM.2, table 1 that was retained and shortened in the revised draft.
11601	20	1	20	2	"...close connection between the level of global warming and regional changes in extremes and many indices of climatic impact drivers...." - Maybe "...regional changes, including extremes and many indices..." could be better because the current formulations could be understood as excluding links to changes to regional climate variables that are not explicitly identified as CIDs? [Gerhard Krinner, France]	Taken into account. Text and table have been simplified radically.
80111	20	2	20	5	It is not fully understood whose uncertainty the text refers to: the projected warming or the cumulative carbon emission? The temperature change has uncertainty but it is not due to the additional forcings. Also, the path-independent approach is not explained here and thus the text is not so clear. [Lilian Fejes, Hungary]	Taken into account. Text moved to Section HS.13 and clarified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
93629	20	2	20	6	New developments in emission metrics (as discussed in the Technical summary and chapter 7) should be presented in the SPM, as this is highly relevant for policy makers. And it seems fair for the SPM to say that newly developed metrics (i.e. GWP*) are promising in capturing the different behaviour of various forcing agents under a unified metrics. This address various shortcomings in traditional metrics, such as the bias from the choice of time horizon. This is not only more valid for methane, but also enables us to take black carbon and other SLCF into the account (which have hitherto been omitted due to shortcomings in the GWP(100) metrics). Lastly, while the carbon budget only account for CO2, new metrics allow for more integrated budgets. [Jon Magnar Haugen, Norway]	Taken into account and addressed in Section HS.13.
97289	20	5			Budgets are not path-independent as they do not apply for overshooting pathways. Please correct. [Nicole Wilke, Germany]	Taken into account. Text moved to Section HS.13 and clarified
65573	20	9	21	14	In SPM2 Tables 1 and 2, the baseline for the estimated amplitudes of projected GSAT and sea-level is given as 1995-2014, whereas the baseline for the timings of warming thresholds is given as 1850-1900. Suggest either using the same baseline, 1850-1900, for both sets of estimates. [Kushla Munro, Australia]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only. Table SPM.2 has been dropped entirely.
87459	20	10	20	12	This sentence might be easier to follow if some of the commas were replaced by m-dashes [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
80113	20	11	20	12	One of the indicators is not the global mean temperature change but the global surface air temperature. Also, the cumulative carbon emissions would be better to be placed before the table of temperature signal as it is the inputs for the table 1 results. On Page 21 line 22 it is claimed that it is derived from the scenario data base. [Lilian Fejes, Hungary]	Taken into account. Text completely rewritten.
81837	20	12			It is clear that Box SPM.2, Table 3 addresses CO2 emissions. However, in the purpose statement (line 12) the term "cumulative carbon emissions is used". The purpose statement and the table itself should be unambiguous that only CO2 is included. "cumulative carbon emissions" should be replaced with "cumulative CO2 emissions" both in line 12 and in the table. Unless it is supposed to be cumulative [carbon] emissions in CO2-equivalent [Dan Zwartz, New Zealand]	Taken into account. Table no longer appears.
27889	20	13	20	13	"IPCC" is missing before "Working Groups". [Eric Brun, France]	Taken into account. Text completely rewritten.
104151	20	15	20	35	The difference among scenarios in the timing of 1.5°C would benefit from an explanation. It is rather counter-intuitive that the two extreme scenarios would reach 1.5°C first, years before the other ones. This is not explained by the CO2 emission trajectories in Box SPM.2, Figure 1. Readers should be informed whether it is just an artefact of short-term variance in the models representing the scenarios, or it is caused by policy-relevant differences (e.g., emissions associated with investments associated with ambitious mitigation action). [Philippe Tulkens, Belgium]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97291	20	15	21	2	Box SPM.2 Table 1: From the numbers given here for the SSP1-1.9 and adding the 0.91°C as explained in the caption it becomes apparent that the average of the SSP1-1.9 are overshoot scenarios reaching temperatures of 1.7°C at least in 2041-2060 period. This is not comprehensively discussed elsewhere neither in SPM nor in TS - overshoot is actually not discussed at all. Since there were a lot of discussions for SR1.5 about overshoot, we request the authors to revise the discussion of these scenarios and clearly state their overshooting character. [Nicole Wilke, Germany]	Taken into account. Text now addresses overshoot in SSP1-1.9.
39535	20	15	21	15	Contrary to the statement, the numbers are not based on "multiple lines of evidence" but mainly on climate models. But a model has not a status of evidence in Science. Experimental evidence from infrared spectra of CO ₂ in the atmosphere, http://dx.doi.org/10.1155/2013/503727 , concludes to a radiative forcing of 2.6 W/m ² at doubled CO ₂ concentration, giving numbers much below those given in these Tables. [François Gervais, France]	Rejected. Statement correct as written.
44769	20	15	21	15	It would be much clearer to the reader if the projections were reported in the table relative to 1850-1900 rather than 1995-2014. This would also make the entries more consistent, considering the "timing"-columns. [Markku Rummukainen, Sweden]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only. Table SPM.2 has been dropped entirely.
69369	20	15	21	15	Although writing numbers in both "likely" and "very likely" ranges is useful, we suggest unifying the ranges in Box SPM.2, Table 1 and Table 2 for the consistency among Tables and reducing pages in the SPM. It might be better to use "likely" ranges because it is used in other bullets in the SPM (e.g. C.2.4, C2.5). [Kaoru Magsaki, Japan]	Taken into account. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only. Table SPM.2 has been dropped entirely. Since the assessment of future change in global surface temperature is entirely in terms of very likely ranges, this has been kept.
15441	20	15	22	2	SSP1-1.9 corresponds to a lower emission scenario compared to SSP1-2.6, as evident from the global cumulative carbon emissions shown in Box SPM.2, Table 3 and the carbon emissions trajectories shown in Box SPM.2, Figure 1. It does not sound reasonable that (i) the temperature increase from 1995-2014 to 2021-2040 in SSP1-1.9 (0.7 C, Box SPM.2, Table 1) is higher than that in SSP1-2.6 (0.6 C, Box SPM.2, Table 1); (ii) the timing of 1.5 C relative to 1850-1900 in SSP1-1.9 (2028, Box SPM.2, Table 1) is earlier than that in SSP1-2.6 (2033, Box SPM.2, Table 1) but the corresponding global cumulative carbon emissions at 1.5 C in SSP1-1.9 (493 GtCO ₂ , Box SPM.2, Table 3) is lower than that in SSP1-2.6 (706 GtCO ₂ , Box SPM.2, Table 3). Please check and revise as appropriate. [SAI MING LEE, China]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.
19537	20	15	22	2	maybe these 3 tables might be contracted into a single one [philippe waldteufel, France]	Taken into account. Only Table 1 has been retained, in a much simpler version.
65575	20	17	20	17	Suggest using a word other than 'evidence', because this section concerns future climate change. Suggest re-phrasing to: "based on multiple lines of analysis", or similar. [Kushla Munro, Australia]	Rejected. Both physical understanding and observations enter the assessment, and both qualify as lines of evidence.
6371	20	17	20	17	The estimates of 2030 for crossing the 1.5°C level given in Table 1 of Box SPM.2 are questionable, for reasons set out in earlier comments 2 to 5, and expanded upon in chapter-specific comments. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Noted. No action item discernible in this specific comment.
27891	20	17	20	18	We understand that the choice made for the reference period reduces the likely range of the projections reported in Box SPM.2 Table 1. Nevertheless we express our preference for choosing 1850-1900 as the reference period. This would be more consistent with the Paris Agreement temperature goal and easier to compare for policy-makers. [Eric Brun, France]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
29207	20	17	20	34	The information "for the five scenarios of the core set of this report" should be added in an appropriate manner for the self-containment. [Hiroshi Kanzawa, Japan]	Accepted. This information has been added to the SPM.
78277	20	17	20	34	Suggest to explain why the timing for reaching 1.5deg of warming for SSP1-1.9 (shared socioeconomic pathway) is much earlier than other SSPs, as it is not immediately intuitive to the reader. [Leonie Lee, Singapore]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.
78279	20	17	20	34	Similarly, suggest to explain why the temperature rise for SSP1-2.6 in the first period is lower than that of SSP1-1.9 (0.6deg vs 0.7deg) [Leonie Lee, Singapore]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.
81421	20	17	20	35	Table 1. I am unclear why you are showing temperature changes relative to 1995-2014 in stead of 1850-1900. Sometimes the latter are shown also. This issue appears elsewhere, and I found myself having to check what baseline was being used. Overall, I suggest it would be simpler to show all temperature changes relative to 1850-1900 as that is more relevant to the policy discussion and would avoid confusion. It would also allow simplification of tables and text. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
42025	20	17	20	35	Box SPM 2, Table 1. If would be helpful if this table could be edited in order to further clarify it. [Juhani Damski, Finland]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
93753	20	17	20	35	Box SPM.2, Table 1: two figures were given for the GSAT change in 2021-2040 in SSP1-1.9 [Quentin Lejeune, Germany]	Accepted. This was a typo. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5.
111467	20	17	20	35	In the Table, there's a stray "0.9" in the GSAT SSP1-1.9 2041-60 box. [James Renwick, New Zealand]	Accepted, typo fixed.
131721	20	17	20	35	Suggest to add in the first column the sentence 'Observed warming in 1995-2014 relative to 1850-1900 is 0.91C' otherwise the reader has to work through the long caption to find this basic information [Hans Poertner and WGII TSU, Germany]	Taken into account. Table SPM.1 has been simplified radically and hopefully clarified.
104153	20	17	20	35	Box SPM2. Please present the temperature increase in this table as relative to 1850-1900 for comparability with the 1-1.1°C warming of the present and the 1.5/2°C goals of policy. [Philippe Tulkens, Belgium]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
104155	20	17	20	35	Box SPM2. Since this box introduces the concept of threshold-crossing time, it should also explain that real-time temperature estimates (e.g. the annual statement of the WMO typically use GMST, and this threshold would be crossed a few years later than a GSAT-based estimate. [Philippe Tulkens, Belgium]	Rejected. This is too technical for the SPM, which is couched entirely in terms of global surface temperature.
117223	20	17	20	35	Table: timing of reaching 1.5C warming (in model projections). Values are different from the result given in SR15, which were calculated from extrapolating current temperature trends. Would be good to clarify this point [Maisa Rojas, Chile]	Accepted. Difference has been clarified.
37789	20	17	21	1	Among the contents of SSP1-1.9 in table 1, period (2041-2060) has a GSAT of 0.8 C and period (2081-2100) has a GSAT of 0.6 C, so please check if this is correct. [Junhee Lee, Republic of Korea]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.
37791	20	17	21	1	Among the contents of SSP1-1.9 in table 1, I wonder why 0.9 is written in the GSAT part of period (2041-2060). [Junhee Lee, Republic of Korea]	Accepted, typo fixed.
37793	20	17	21	1	In table 1, check if timing of 1.5 C in SSP1-1.9 (2028) is faster than SSP1-2.6 (2033). [Junhee Lee, Republic of Korea]	Taken into account. Numbers have been updated, no longer showing the counterintuitive behaviour; text has been completely rewritten.
97293	20	17	21	2	Please add information relative to the "AR5-temperature" which is relevant for the Paris Agreement. [Nicole Wilke, Germany]	Accepted. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44069	20	17	21	2	Our understanding was that RCP1.9 was designed to be an emission scenario compatible with the Paris Agreement, hence staying below the 1.5°C limit at the end of the century. However, the numbers given in this table seems to contradict that. The legend of the table suggests that part of this mismatch is due to the historical warming between the preindustrial reference period and 1995-2014, which is calculated differently in comparison to the assessment of GMT change in previous IPCC reports. This is an illustration of the fundamental problems introduced by the consideration of a new temperature metric, which have been described more extensively above. Please include estimates that are based on the AR5 methods so that a transparent comparison is possible. [Lamin Mai Touray, Gambia]	Taken into account. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5. That said, our assessment shows that even under SSP1-1.9, staying below 1.5 °C is not guaranteed.
104157	20	17	21	2	Box SPM 2 Table 1 should be improved by replacing n.a by dates when they are exceeding the threshold beyond 2100, in order to be more consistent qwith Box SPM 2 Table 2 where element are provided up to 2300. If providing such figures is not possible, additional explanations should be provided to better understand "n.a" occurences: does this mean the associated temperature will never be achieved (perhaps the case for SSP1-1.9)? Or it will be achieved after 2100 (perhaps the case for SSP1-2.6 and SSP2-4.5)? [Philippe Tulkens, Belgium]	Taken into account. Table SPM.1 has been simplified radically and no longer shows when warming levels are reached or crossed.
78603	20	17			Table 1 in Box SPM2 is huge and complex. Much of this great info can be shown graphically – if people really want a big table of numbers, then it sits better in the TS. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
89909	20	17			Box SPM.2 Table 1 highlights Trinidad and Tobago's concerns as it relates to the new GSAT temperature indicator which must now be corrected to match the GMST. It is difficult to reconcile the corrected GSAT to GMST historic warming of 0.91oC with the AR5 historic warming of 0.78°C between the 1850-1900 and the 2003-2012 periods, in the absence of clear explanations; especially since this has major implications for the SSP1-19 projections up to 2100 and the related 1.5oC pathway of the Paris Agreement. How do we convince policy makers of this major difference? We appreciate the progress of the science but there is also an absolute need to bring clarity with the progress made. We recommend that information be presented that clearly shows the relationship between the climate metric used in AR5 and the new SSP projections. The current information presented is very confusing. [Joanne Deoraj, Trinidad and Tobago]	Accepted. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5.
41307	20	17			Box SPM.2 Table 1: Similar to Box SPM.2 Figure 1, this table should contain GSAT estimates relative to pre-industrial (1850-1900). Maybe this could be done by adding the pre-industrial values to each of the cells in the first three columns in a different colour. And to allow for a transparent treatment of the metrics change compared to AR5, it would be good if the estimates could also be provided using the AR5 method. In order to do that the 'timing' part of the table could be split off and become a separate table. [Alexander Nauels, Germany]	Taken into account. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87135	20	17			<p>In Box SPM.2 Table 1 we are seeing the fundamental problem coming with switching from the AR5 temperature metric base to corrected GMST/GSAT as we are left with no true 1.5 degC pathway in the Paris Agreement sense (when combining 0.91 degC of historical warming with SSP1-19 projections for 2100). The AR5 has assessed historic warming between the 1850-1900 and the 2003-2012 period to be 0.78°C. Now historic warming until 1995-2014 is assessed to be 0.91°C. No line of sight is presented, no differences are explained. How will policy makers reconcile this? There is no information provided to why this change was made. Technical Summary Box.1 states that “dataset innovations and new products since the AR5” have increased this value by 0.1°C. But how? And why was this changed and how does this relate to the Paris Agreement that was informed by AR5? The IPCC should not just change metrics that are directly policy relevant due to ‘innovations’. The Paris Agreement temperature goal is linked to extensive impact assessments including those conducted under the 2013-2015 Periodic Review, which were informed by the AR5. Information that is to inform the Paris Agreement needs to be provided in the same metric in order to allow tracking progress. If the IPCC was to change with every assessment report how global mean temperature is being assessed, this would create massive issues with the global stocktake and lead to a lot of confusion. While scientific progress is very much appreciated, there needs to be a clear line of sight to the Paris Agreement, i.e. a second table that is showing combined observations and SSP projections based on temperature metrics used in the AR5. [Jacqueline Spence, Jamaica]</p>	<p>Taken into account. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5. However, it would be confusing to readers and thus counterproductive to display, in parallel, results based on knowledge that has now been superseded. The report is not policy-prescriptive because it "merely" assesses the newest literature on past and future change in global surface temperature.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89445	20	17			<p>There is one issue of overarching relevance that needs to be addressed. Through correcting short-comings with historical warming estimates used in the AR5, the assessment of warming over the historic period is ~0.1°C higher now than in the AR5 that has informed the Paris Agreement. This is a pure change in metric that does not affect the impact assessment that has informed the Paris Agreement (see also decision 10/CP.21). This shift leads to an unintended shift in the goalposts of the Paris Agreement without the necessary line of sight towards the Agreement. Thus, the report runs the risk of becoming policy prescriptive as it is not up to the scientists to choose which GMT metric should inform the PA and the policy process.</p> <p>The impact assessments that have informed the Paris Agreement temperature goal are based on the global mean temperature metric deployed in the IPCC AR5.</p> <ul style="list-style-type: none">•The Paris Agreement Article 2.1a refers to impact assessments at temperature levels above pre-industrial•The Paris Agreement was informed by the science of the time as reflected in the IPCC AR5 and assessed in the Structured Expert Dialogue (SED) of the 2013-2015 Review•The AR5 provided impact projections based on GMST (in HadCRUT4) until the 1986-2005 reference period and GSAT thereafter•The AR5 assessed historic warming since 1850-1900 based on the HadCRUT4 dataset as 0.61°C until the 1986-2005 reference period•At the time of the AR5, issues with a GMST HadCRUT4 type of temperature metric compared to GSAT where not well established and not communicated to policy makers. <p>In the context of relating AR6 findings to the Paris Agreement, re-assessing the historic warming with metrics different than those that have informed the Paris Agreement is inconsistent with the Paris Agreement and the high level of scientific consensus.</p>	<p>Taken into account. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5. However, it would be confusing to readers and thus counterproductive to display, in parallel, results based on knowledge that has now been superseded.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89447	20	17			<ul style="list-style-type: none"> Following Tokarska et al. (2019), adequate treatment of temperature metrics in the context of the Paris Agreement requires a full translation back to the metric that has informed the Agreement The backwards conversion or usage of metrics from previous reports has precedent in the IPCC. For example for Global Warming Potentials, different metrics following different IPCC reports (e.g. GWP_SAR, GWP_AR4) have been used and deployed in the IPCC to inform policy With an ever evolving science, forthcoming reports will face similar problems as the AR6 when dealing with the temperature metric problem. The AR6 thus needs to provide a solution for this issue <p>The proposed suggestion therefore is to introduce a GMT_AR5 metric that follows the treatment of GMT in the AR5 WG1. (GMST based on HadCrut4 1850-1900 to 1986-2005 (0.61°C) and GSAT thereafter).</p> <ul style="list-style-type: none"> This metric should be used for all assessments that combine historic and projected warming and are intended to provide information in relation to the Paris Agreement. This includes the assessment of the RCPs as well as all figures that show global mean temperature trajectories. The proposal is to show a main y-axis with warming relative to the 1995-2014 reference period and a second y-axis showing warming in GMT_AR5 <p>It is important to highlight that the proposal is not to replace the current approach or to question scientific progress. This is what the IPCC is set out to reflect. But it is also meant to inform policy and thus needs to provide information in such a way that they can be also be linked and understood in relation to key policy documents and processes such as the Paris Agreement. [Carl-Friedrich Schleussner, Germany]</p>	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
99979	20	17			<p>In Box SPM.2 Table 1 we are seeing the fundamental problem coming with switching from the AR5 temperature metric base to corrected GMST/GSAT as we are left with no true 1.5 degC pathway in the Paris Agreement sense (when combining 0.91 degC of historical warming with SSP1-19 projections for 2100). The AR5 has assessed historic warming between the 1850-1900 and the 2003-2012 period to be 0.78°C. Now historic warming until 1995-2014 is assessed to be 0.91°C. A better explanation is required on the need for the change and how it affects the previous agreements made based on AR5 and country's are expected to continue their tracking process. This may cause confusion with different metric being used based on preferences, therefore a clear link needs to be made with the new metric and the previous metric highlighted in AR5. Perhaps an analysis of the SSP projections with the temperature metrics used in AR5. [Caroline Eugene, Saint Lucia]</p>	<p>Taken into account. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5. However, it would be confusing to readers and thus counterproductive to display, in parallel, results based on knowledge that has now been superseded.</p>

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68801	20	17			In Box SPM2 Table 1, switching from the AR5 temperature metric base to corrected GMST/GSAT has created a serious problem. There is no true 1.5 oC pathway, when combining 0.91 oC of historical warming with SSP1-19 projections for 2100. The AR5 has assessed historic warming between the 1850-1900 and the 2003-2012 period to be 0.78°C. Based upon what is shown in this document, historic warming until 1995-2014 is assessed to be 0.91°C and no line of sight was presented. Please explain the differences. As outlined, it will be very difficult for policy makers to understand. Technical Summary Box1 states that “dataset innovations and new products since the AR5” have increased this value by 0.1°C. It is important to explain the change. The Paris Agreement temperature goal is linked to extensive impact assessments including those conducted under the 2013-2015 Periodic Review, which were informed by the AR5. Information that is to inform the Paris Agreement needs to be provided in the same metric in order to allow tracking progress. While scientific progress is very much appreciated, there needs to be a clear line of sight to the Paris Agreement. A second table that is showing combined observations and SSP projections based on temperature metrics used in the AR5 would be useful. [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Table SPM.1 caption now contains comparison to the historical warming assessed in AR5. However, it would be confusing to readers and thus counterproductive to display, in parallel, results based on knowledge that has now been superseded.
130045	20	17			Can this table be updated? Surely there are more projections for the various SSP scenarios available now. [Trigg Talley, United States of America]	Taken into account. Numbers have been updated; text has been completely rewritten.
41309	20	18	20	18	This is the first instance the new AR6 reference period is mentioned. Given that reference periods have shown to be potentially contested in the past, it would be great to use Box SPM.2 to briefly introduce the reference period and clarify why it has changed compared to AR5, even in a footnote. [Alexander Nauels, Germany]	Taken into account. Reference periods and changes since AR5 now explicitly included in Table caption.
50511	20	20	20	20	Please replace "temperature thresholds" with "global warming levels" as used on page SPM-19 line 48 and line 29 later in this paragraph. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted and reformulated throughout the SPM.
37637	20	20	20	21	Chapter 4 SOD says 0.86 deg C for the difference between 1995-2014 and 1850-1900 (4-36, 1.4-5)? [Masahide Kimoto, Japan]	Taken into account; slightly different numbers reflected different stages of finalization in Chapters and SPM. Numbers are now consistent.
37507	20	20	20	23	Your confidence that global average temperatures can be derived from temperature data from 1850-1900 is touching but entirely misplaced. Haven't you looked at the global data coverage across this period? According to HadCRUT4 data it never exceeded 50% during that time and in 1861, for example, it averaged less than 15% for the entire year. It's simply laughable that you think that data calculated from those phony global averages can be accurate to two decimal places. [John McLean, Australia]	Noted. No action item discernible in this specific comment. The larger uncertainty in global temperature estimates arising from limited sampling in earlier parts of the record is known, and incorporated in the uncertainties reported in this assessment (see chapter 2).
7689	20	20	20	29	The term "emulator" is used for the first time. It is a quite technical term and should be explained - e.g. by a footnote in the box or some additional sentence in the box. E.g. emulator is hardware or software that enables one computer system (called the host) to behave like another computer system (called the guest). [Klaus Radunsky, Austria]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
50243	20	21	20	21	1995-2014: why are all of the temp changes relative to 1995-2014 in Box SPM2, rather than relative to 1850-1900, as temp rise compared with pre-industrial is more policy relevant? Would it be possible to include these figures here too? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
131723	20	21	20	21	Box TS.4, Table 1 does not exist [Hans Poertner and WGII TSU, Germany]	Accepted and corrected.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65577	20	21	20	23	Suggest also adding a figure to convert to 1986-2005 so that readers can compare with AR5. Also suggest providing a table with conversion numbers for a range of periods in body of report if it is not done already. [Kushla Munro, Australia]	Taken into account. Some conversion information added to the Table SPM.1 caption; for more information, please see TS and Chapter 4.
107493	20	21	20	23	A column should be added to Box SPM.2, Table 1 that adds 0.91°C to the best estimate for the selected periods "to provide an approximation for the GSAT change relative to the 1850-1900 reference period." Otherwise you are just forcing policy makers to do the math and create the table for themselves. Policy is referenced to the 1850-1900 period. [Hunter Cutting, United States of America]	Taken into account. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
64797	20	22	20	22	The statement notes 0.91 °C is added to the best estimate of ranges; however, the estimates presented in the table use only two significant figures indicating a difference in measurement resolution. Recommend three significant figures for estimates presented when 0.91 °C is indeed added or otherwise stating 0.9 °C is added. Also recommend this for other areas when relevant. [Casey Kopcho, United States of America]	Rejected. To enable readers to easily recognize the numbers based on observations, they are quoted verbatim.
51999	20	22	20	23	Does the 0.025 sea level rise include the Greenland and Antarctica? [Daniel Rosenfeld, Israel]	Noted. Sea-level number no longer appears.
54651	20	23	20	25	Box SPM.2 Table 1 caption: This statement, that the results in columns 6-9 (timing of crossing a threshold) are estimated for human-induced warming (in GSAT) and do not include the uncertainty arising from natural variability requires further explanation. Need to be clear why this is not captured in the 5-95% model range which readers may assume captures internal variability to some extent as well as model uncertainties. Also need to be clear whether or not this a different temperature metric than the results in columns 3-5? [Nancy Hamzawi, Canada]	Taken into account. Final numbers do include internal variability.
9627	20	23	20	25	I am worried that "uncertainty arising from natural variability" is not accounted for. I interpret this sentence to mean two things. First, there is some degree of natural variability on top of human-induced warming. It think it should be considered. Second natural variability may have influenced recent trends and this has an impact on observational estimates of TCR and ECS and thus on what CMIP6 models imply for the 21st century. I am worried if natural variability is not considered here. We have CMIP6 historical members which are very realistic over the industrial period, and for which SSP119 goes above 2°C (even in terms of the human-)induced warming), so it is weird to see that SSP119 has more than 95% of chance of staying below 2°C (table 1 in box SPM2). [Olivier Boucher, France]	Taken into account. Final numbers do include internal variability.
65579	20	25	20	25	Suggest clarifying the sentence to either omit the uncertainty component, or rephrase in terms of observed global average temperature. We suggest using a different term, rather than "natural variability", which has the potential to delay or bring forward the time at which observed global temperature rises and stays above a given threshold. There is uncertainty in the observed temperature, and not uncertainty in the underlying human-induced warming. That is a separate factor. [Kushla Munro, Australia]	Taken into account. Final numbers do include internal variability.
2971	20	25	20	30	Please add the numbers of CMIP6. All figures and tables of SPM should give the numbers of CMIP6. [Zong Ci Zhao, China]	Rejected. The reviewer asks for model documentation; the SPM is not the place for that. Instead, it presents the assessed change.
27893	20	26	20	28	A minimum information on how it is done should be provided in the text. [Eric Brun, France]	Taken into account. Text now simplified and harmonized.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130047	20	28	20	31	A consistent methodology should be applied for all SSPs. [Trigg Talley, United States of America]	Taken into account. Text now simplified and harmonized.
97295	20	28			Please explain what an "emulator" is, or use the expression "simple climate model". [Nicole Wilke, Germany]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
42233	20	28			Box SPM2, Table 1, caption, L28: Please explain "emulator results" [Tina Christensen, Denmark]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
44767	20	33	20	33	Percentages are unclear. Are they of GMST in Kelvin? Or of GMST change? [Markku Rummukainen, Sweden]	Taken into account. Sentence no longer appears.
86569	20	34	20	35	Table 1 You write "GSAT are assessed to be about 4% higher than equivalentGMST". This is only correct for present day warming, not for any level of warming in the future. This inflating factor will increase with warming (as acknowledged in chapter 2). It is hence misleading to say this here in the context of future projections. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence no longer appears.
54653	20	35	20	35	Box SPM.2 Table 1: Too much work is required of the reader to mentally add 0.91C to each of the results in columns 3-5 to get approx. changes in GSAT relative to pre-industrial in order to scroll across all the rows and make sense of the results in columns 6-9 which are given relative to pre-industrial. Strongly recommend adding the changes relative to pre-industrial into columns 3-5 so that scrolling across all the rows readers can see some consistency in results. [Nancy Hamzawi, Canada]	Taken into account. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
34531	20	35	20	35	The formatting of SPM.2 Table 1 is cumbersome. Some simple changes could make things much more readable -- e.g., the main value in each cell could be in a slightly larger font, and the range could be on the next line in a smaller font with a dash between the numbers. [Russell Vose, United States of America]	Taken into account. Table SPM.1 has been simplified radically.
46567	20	35	20	35	I am worried that the difference across scenarios in the timing of 1.5 °C primarily reflects internal variability and model-selection biases rather than a true difference between scenarios. This is the more the case as the number of simulations available for each scenario differs widely. I suggest to repeat the analysis with the same model sub-set to examine the robustness of the spread [Dirk Notz, Germany]	Taken into account. Table now simplified and harmonized.
36151	20	35			SSP1-1.9 @ 2041-2060 has an extra '0.9'? [Michael PRATHER, United States of America]	Accepted. Typo fixed.
36153	20	35			This table is hard to understand without the note in the text about the 0.91C to be added to get the warming since PI. It would be helpful to put it in the table, how about a merged cell under the titles in columns 3-4-5. [Michael PRATHER, United States of America]	Taken into account. Table SPM.1 has been simplified radically and now shows changes relative to 1850--1900 only.
131725	20	35			This is not the same metric of 1.5C global warming as given in the SR15 which used GMST - and 1.5 is reached earlier in this table [Hans Poertner and WGII TSU, Germany]	Taken into account. Table SPM.1 has been simplified radically. The difference to SR1.5 is explained earlier in the SPM.
50245	20	Table	20	Table	If we are comparing the future temp projections to a recent baseline then why is a period ending in 2014 chosen, rather than 2018 (or even 2019) if we have several full years of temp data since 2014? It would be helpful to clarify this or provide a line of sight to the explanation in the underlying report. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text now shows changes relative to 1850--1900 only.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50247	20	Table	20	Table	Are the numbers in brackets in Table 1 Box SPM2 'likely' ranges? If so, why commas between the numbers rather than hyphens? Also, the later timing of 2 degrees under SSP2-4.5 compared with SSP5-8.5 could be taken to mean that a higher fossil fuel trajectory is actually better for global temperature response (clearly factoring in aerosols and their component of the scenario). Perhaps an explanatory note for this? Or a column specifying the aerosol component? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text and table have been simplified radically.
86571	20		20		Box 2 Table 1. I think it is very dangerous to give report time of reaching 1.5°C and other targets. Several issues : 1) as this is calculated for GSAT, that means that by that time GMST will still be below the target. IPCC will look like it got it all wrong and was alarmist. 2) The fact that SSP1-1.9 has a sooner time (2028) than some higher scenarios (ex SSP2-4.5), is counter-intuitive and will generate more questions than providing useful information. You might consider showing these dates as a range across scenarios. 3. You must realise that you are essentially saying that we will experience a warming of 0.4°C in 8 years. In the SR1.5, the current rate of warming was 0.2°C per decade. How could this jump to 0.5°C per decade ? Is this based on when models reach that target or when models are warming 0.4°C more than present (or with respect to the baseline used here). How do you remove model biases ? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Former Box 2, table 1 removed from new Box SPM.1 and overall SPM.
116099	20		20		For the timing of reaching different temperature levels, here and in Chapter 4, I suggest to provide a range of years (not a single year). There is a need for a concise description of reasons for changes compared to AR5 and SR (observed warming level + method GSAT + assessed transient response). Applying the exact same method on datasets from AR5, and each change since AR5 (observed warming; GSAT vs hybrid approach; CMIP6 compared to CMIP5; assessed transient response in AR6 compared to AR5) would be very helpful. [Valerie Masson-Delmotte, France]	Not applicable. Former Box 2, table 1 removed from new Box SPM.1 and overall SPM.
26031	20		20		In Box SPM.2, table 1, there appears two values for “Global Surface Air Temperature Change”, scenario SSP1-1.9, Period 2041-2060 relative to 1995-2014. Please, select 0.8 or 0.9. [Don Alfonso Pino Maeso, Spain]	Accepted. Typo fixed
17481	20				SPM.2. The tables are particularly helpful but initially I worried about the repetition of information of GSAT and SLR in C1 and C2. On balance I think it is needed to ease assimilation of the additional points made in the text. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. For space constraints reasons we have decided to shorten and refocus the new Box SPM.1 to just introducing the illustrative scenarios and the climate models. Results from climate projections are now only presented as part of the main SPM sections B, C and D.
17483	20				SPM.2, Table 1: The timing of 1.5C perhaps as early as 2022 (i.e. within a year of this report being published) will be particularly noteworthy. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
42361	20				SPM.2 table 1: Global surface Air temperatur: it is stated that timing of 1.5 degrees for SSP1-1.9 is 2028 but only later for the other SSP scenarios. It seems illogical? [Tina Christensen, Denmark]	Taken into account. Text and table have been simplified radically.
15443	21	1	21	15	Box SPM.2, Table 2 shows that the GMSL rise in 2100 under SSP5-8.5 is 0.73 m. This does not tally with the projection shown in Table 4.5 of Ch.4, in which the GMSL rise in 2081-2100 under SSP5-8.5 is already 0.73 m and GMSL rise is basically monotonically increasing. [SAI MING LEE, China]	Not applicable. Table removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
15445	21	1	21	15	Box SPM.2, Table 2 shows that the GMSL rise in 2100 under SSP5-8.5 is 0.73 m relative to 1995-2014. Accounting for the change in reference period from AR5 and AR6, the AR6 projected GMSL rise in 2100 under SSP5-8.5 is about 0.76 m relative to 1986-2005, which is about 10% lower than the projection under RCP8.5 given by SROCC. Both SROCC and AR6 have stressed that GMSL rise has accelerated in recent decades (SROCC SPM, P.10, A.3; AR6 WGI SOD, Ch.9, P.7, lines 19-22) . This AR6 GMSL rise projection may be perceived by some policymakers as an internal inconsistency between SROCC and AR6. Even worse, it may be mis-interpreted that the risk of sea level rise was overestimated previously by IPCC. It is strongly suggested to double check the validity of this GMSL rise projection. [SAI MING LEE, China]	Not applicable. This table was removed from the revised SPM.
69371	21	5	21	15	The global mean sea-level projections including ranges of uncertainty shown in Box SPM.2 Table 2 have been revised in comparison from AR5 and SROCC. Since the values in the table will be used frequently in cross-WG activities, it would be essential to clarify the reasons for the changes in the projections since AR5 and SROCC and provide a brief description. [Kaoru Magosaki, Japan]	Not applicable. Table removed from the revised SPM.
50249	21	7	21	7	Suggested edit for clarification: '...global mean sea-level projections, derived from climate models alone' (if that is correct) [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
54655	21	7	21	7	Box SPM.2 Table 2: Recommend including the percentiles for the likely and very likely ranges be explicitly included in the table caption as they were for Box SPM.2 Table 1. [Nancy Hamzawi, Canada]	Not applicable. Table removed from the revised SPM.
8147	21	7	21	7	It may be useful (like for temperatures) to provide the sea level rise until 2014 for reference. [Frank Dentener, Italy]	Not applicable. Table removed from the revised SPM.
104159	21	7	21	7	It may be useful (like for temperatures) to provide the sea level rise until 2014 for reference. [Philippe Tulkens, Belgium]	Not applicable. Table removed from the revised SPM.
27895	21	7	21	7	Missing the "observed sea-level rise in 1995-2014 relative to 1850-1900", as for temperature. [Eric Brun, France]	Not applicable. Table removed from the revised SPM.
50251	21	7	21	12	Could the Table 2 (Box SPM1) description of GMSL projections also mention here the challenges climate models face in resolving abrupt ice sheet collapse dynamics? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
93755	21	7	21	13	Box SPM.2, Table 2: The addition of post-2100 increases sea-level projections in the next draft will be very relevant. [Quentin Lejeune, Germany]	Not applicable. Table removed from the revised SPM. Note however that fig SPM.8 now shows sea level projections in 2300, for 2 scenarios
93757	21	7	21	13	Box SPM.2, Table 2: for the sake of simplicity, the column giving changes in 2100 or that giving changes in 2090 could be removed [Quentin Lejeune, Germany]	Not applicable. Table removed from the revised SPM.
104161	21	7	21	13	The years chosen for the columns may not be most informativem with two pairs of values just 10 years apart. Whilst it can give auseful indication of expected decadal rate of increase during these periods, that could be indicated more intuitively through other means. [Philippe Tulkens, Belgium]	Not applicable. Table removed from the revised SPM.
104163	21	7	21	13	"Long-term sea level estimates will be added for FGD if available": Figure SPM.7, panel (f) seems to have these data for three scenarios. [Philippe Tulkens, Belgium]	Not applicable. Table removed from the revised SPM.
97297	21	7	21	14	Why different likelihoods than in previous table? What is the difference to preindustrial, 2075. Suggestion to delete: Is this relevant, given that the long term SLR is much more significant? Why two ranges and only one above? [Nicole Wilke, Germany]	Not applicable. Table removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42027	21	7	21	15	Box SPM2, Table 2. Are both "likely" and "very likely" uncertainty ranges needed in this Table (cf. Box SPM.2, Table 1, where only the "very likely" range is given)? [Juhani Damski, Finland]	Not applicable. Table removed from the revised SPM.
41311	21	7			Why provide 2150 values? 2200 would make more sense, intuitively. The value added by adding another suite of GMSLR estimates 50 years after 2100 is low. And fingers crossed, that the hugely important 2300 GMSLR values find their way into the FGD, in particular for SSP1-19. [Alexander Nauels, Germany]	Not applicable. Table removed from the revised SPM. Note however that fig SPM.8 now shows sea level projections in 2300, for 2 scenarios
131727	21	7			If long-term sea level estimates are not available for the FGD, then either refer the reader to SROCC in the caption, or replace the last two columns with three columns for 1 RCP, and 2-3 SROCC projections [Hans Poertner and WGII TSU, Germany]	Not applicable. Table removed from the revised SPM.
130049	21	8	21	8	Why is "(likely)" in parentheses and "[very likely]" in brackets? Should they have the same format? [Trigg Talley, United States of America]	Not applicable. Table removed from the revised SPM.
130051	21	9	21	9	"Meters" is misspelled. [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
54657	21	9	21	9	Box SPM.2 Table 2: The figure caption refers to changes in sea level relative to "specified time periods" whereas the table itself gives changes for specific years (2040, 2050 etc). Do the years in the table represent mid points of 20-yr time periods consistent with those in Box SPM.2 Table 1 and 3? [Nancy Hamzawi, Canada]	Not applicable. Table removed from the revised SPM.
101565	21	9			Change "metes" to "metres" [Knut Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
79347	21	9			...ensemble in metes for the specified... Comment: replace metes with meters [Rolf Philipona, Switzerland]	Not applicable. Table removed from the revised SPM.
46565	21	11	21	11	Section 9.3.6 should become section 9.6.3 [Dirk Notz, Germany]	Not applicable. Table removed from the revised SPM.
131729	21	13	21	13	The figures listed in the table would be much easier to read, if each bracket had its own line - just write them underneath each other and add the definition "(likely)" and "{very likely}" in the column with the scenario names - this way the reader does not have to read the caption 5 times to understand the values given in the table. [Hans Poertner and WGII TSU, Germany]	Not applicable. Table removed from the revised SPM.
34533	21	13	21	13	The formatting of SPM.2 Table 2 is rather cumbersome as well. Some simple changes could make things much more readable -- e.g., the main value in each cell could be in a slightly larger font, and the range could be on the next line in a smaller font with a dash between the numbers. Also, presumably the units are meters, not 'metes.' [Russell Vose, United States of America]	Not applicable. Table removed from the revised SPM.
86115	21	13	21	14	It seems strange to have years at irregular intervals 2040-50-90-100. Any particular reason why this is not shown for 40-60-80-100? In the following table it is 30-50-90. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Table removed from the revised SPM.
69373	21	13	21	28	The "Sea Level Rise (m)" and "Illustrative Cumulative Carbon Emissions (GtCO ₂)" in top-leftmost cells should be moved to the second cells as same as Box SPM.2, Table 1. [Kaoru Magosaki, Japan]	Not applicable. Table removed from the revised SPM.
36155	21	13			Yes, it is important to have some context here, before you said something about SLR from 1900-to? [Michael PRATHER, United States of America]	Not applicable. Table removed from the revised SPM.
131731	21	13			What is the range of the baseline 1995-2014? [Hans Poertner and WGII TSU, Germany]	Not applicable. Table removed from the revised SPM.
27897	21	13			Regarding Box SPM.2, Table.1: line 1, column 3: "Year 2040" should be "2030". [Eric Brun, France]	Not applicable. Table removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44131	21	18	21	21	What is the policy-relevance of quantifying some sort carbon budgets for these various scenarios, especially without uncertainty ranges, when these numbers are so uncertain and the context to interpret the scenario dependencies is missing? It may for example be perceived as a justification to engage on a SSP2-4.5 scenario to achieve 1.5°C as the budget to remain under 1.5°C is highest for this scenario. It sends a similarly confusing signal about SSP1-1.9, which has the lowest cumulative carbon emissions at 1.5°C whereas this scenario is the most likely among the set of five to keep global warming below 1.5°C above pre-industrial levels. Because of the difficult interpretation of this Table, it would make more sense to remove it. [Lamin Mai Touray, Gambia]	Taken into account. Table removed from the revised SPM.
104165	21	18	22	2	Box SPM 2 Table 3 should be improved by replacing n.a by dates even when they are exceeding thresholds beyond 2100, in order to be more consistent qwith Box SPM 2 Table 2 where element are provided up to 2300. If providing such figures is not possible, additional explanations should be provided to better understand "n.a" occurrences: does this mean the associated temperature will never be achieved (perhaps the case for SSP1-1.9)? Or it will be achieved after 2100 (perhaps the case for SSP1-2.6 and SSP2-4.5)? [Philippe Tulkens, Belgium]	Not applicable. Table removed from the revised SPM.
78615	21	18			Table 3 in Box SPM2. Why are the table entries for carbon emissions listed as “estimate” relative to 2015. For the given scenarios these are known amounts. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
78617	21	18			Table 3 in Box SPM2. Why have a column for 2090? Better to go to 2100. The emissions are monotonically varying without interannual variability so no need to average over a decade – you can just take the end-of-century number [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
37639	21	20	21	20	Why not showing uncertainty range in this table? (Excuse me for not having checked with original Ch drafts.) [Masahide Kimoto, Japan]	Not applicable. Table removed from the revised SPM.
50253	21	20	21	20	As per an earlier comment on choice of temperature baselines, why are carbon emissions given here relative to 2015, missing out on at least 3 years of emissions data? It would be helpful to clarify the reason for this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
130053	21	20	21	28	Should there be a mention of global warming potential here too? [Trigg Talley, United States of America]	Not applicable. Table removed from the revised SPM.
81839	21	20	21	28	Unless the cumulative emissions are emissions of CO2 and other ghgs, there is no need to use the term "cumulative carbon emissions". Line 20 could be reworded "Global cumulative CO2 emissions..." and likewise the header for column 1 of the table [Dan Zwart, New Zealand]	Not applicable. Table removed from revised SPM.
97299	21	20	22	1	Please clarify that these timings of cumulative emissions is prescribed by the scenarios. [Nicole Wilke, Germany]	Not applicable. Table removed from the revised SPM.
42029	21	20	22	1	Box SPM 2, Table 3. If would be helpful if this table could be edited in order to further clarify it. [Juhani Damski, Finland]	Not applicable. Table removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37795	21	20	22	1	Illustrative Cumulative Carbon Emissions' were calculated as compared to 2015, but the global warming level is expressed as compared to 1850-1900, which may confusion about understanding the baseline. Therefore, rather than expressing 'relative to 2015' after year 2030/2050/2090, it is suggested to express after 'Illustrative Cumulative Carbon Emissions'. (Like Illustrative Cumulative Carbon Emissions relative to 2015) [Junhee Lee, Republic of Korea]	Taken into account. Box SPM.2, Table 3 removed from revised SPM.
37797	21	20	22	1	Among the contents of SSP1-1.9 in table 3, check that the Year 2050 and Year 2090 values of 'Illustrative Cumulative Carbon Emissions' are correct. [Junhee Lee, Republic of Korea]	Not applicable. Table removed from revised SPM.
114933	21	20	22	1	I think it is confusing to include a table on cumulative emissions here. This is not a property of the climate response and the cumulative CO2 emissions at the time of crossing a temperature level will strongly depend on the non-CO2 warming at that point, which depends on the non-representative non-CO2 emissions profile attached to the particular SSPx-y scenario. It is therefore virtually guaranteed that those numbers will be inconsistent with the numbers for peak warming levels derived by the WG3 assessment based on a much larger set of scenarios. I suggest to remove the table on cumulative emissions in the box. [Elmar Kriegler, Germany]	Taken into account. Table removed from revised SPM.
50515	21	20	22	2	Box SPM.2 Table 3: Please provide information on the likely and/or very likely ranges for the cumulative emissions estimates, as has been done for Global Surface Air Temperature and Sea Level Rise in Tables 1 and 2 of this box. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from the revised SPM.
69375	21	20	22	22	It is understood that each of the five scenarios is an illustrative marker scenario among other alternatives with the same socio-economic and forcing mitigation assumptions. This implies that the cumulative CO2 emissions in Table 3 as well as emission trajectories in Box SPM.2 Figure 1 are subject to the choice of the marker scenarios. This scenario uncertainty would merit being remarked appropriately in a footnote in order to avoid improperly quoting the number of emissions. [Kaoru Magosaki, Japan]	Not applicable. Box SPM.2, Table 3 removed from revised SPM.
130055	21	20	22	24	[SCOPE] Inclusion of the cumulative emissions framing is NOT necessary in the SPM of the WGI report. Box SPM.2 Figure 1 is a good figure, but it's more appropriate for the SYR than the WGI report. Maybe it can be retained here with some limited context provided. However, Box SPM.2 Tables 1 and 2 are great and valuable -- and enough. Box SPM.2 Table 3 should be deleted; it's a level of detail NOT necessary for the SPM. [Trigg Talley, United States of America]	Taken into account. Table removed from the revised SPM. However, Box SPM.2 Figure1 has been retained and revised, to provide context about the scenarios.
89911	21	20			Overall, we find that the information on the remaining carbon budget lack cohesiveness and needs enrichment. For example, Box SPM.2 Table 3 sends a misleading message with regard the remaining carbon budgets and should be deleted completely. The numbers as presented, gives the false impression that there is time left under SSP5-85. Information on the remaing carbon budget is also presented disjointedly. Given the sensitive nature of the remaining carbon budget topic, we recommend that this information should be presented in a consice and focused way. [Joanne Deoraj, Trinidad and Tobago]	Taken into account. Box SPM.2, Table 3 removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36157	21	20			I have a scientific problem here in that the non-CO2 emissions greatly affect these numbers and it is misleading to ignore the SLCFs. The equivalent CO2 cumulative (based on the SLCFs steady state ERF) at the time should be included, perhaps a +xxx with each CO2 cumulative emissions. This is a problem with the assessment as is, when it goes into CO2-mode, all other climate forcers are forgotten.. [Michael PRATHER, United States of America]	Not applicable. Table removed from the revised SPM. Note however
66179	21	20			<p>The role of N2O in cumulative carbon emissions is understated in this report. The sections where CCE and N2O are/could be discussed include 1.6.3 (Fig1.26), 5.5.2.2.3 (Fig 5.31), 7.1, SPM Box 2 (Table 3). For example, Ch. 7 has a key statement: "Therefore, the impacts of CO2, N2O and other long-lived gases are usually functions of cumulative emissions.(P 7-113 / L34)".</p> <p>The discussion about the linearity of the CCE vs T response across scenarios and the conclusion is a bit optimistic, especially when looking at 1.5C or 2C, where CCE ramps down and may reverse. For these, I question the utility of TCRE/CCE without including N2O.</p> <p>For example, the CCE for the two lowest warming SSPs is 578 & 1279, while the equiv CCE-N2O over the same period (2015-2090) ranges from 190 to 350 GTCO2e, a large fraction of the CCE.</p> <p>The problem with ignoring N2O is that the path to carbon neutrality is unlikely to reduce N2O: for CO2 it is CCS/BECCS and renewable energy, while for N2O, it is based on feeding people. The ability to control N2O emissions from fixed-N is not well studied and has no obvious strategy (at least as I can find here). N2O emissions look harder to control than any other SLCFs like CH4. There is an odd note (Ch 5-88 L14) that says something about "used to estimate the non-CO2 contribution across a wide variety of stringent mitigation scenarios (Huppmann et al., 2018)" - I looked up the Huppmann commentary, but could find little on non-CO2 or N2O.</p> <p>Maybe putting the SLCF & N2O equiv CCE in SPM Box 2 Table 3 would add a useful perspective. [Michael PRATHER, United States of America]</p>	Taken into account. N2O now features more prominently in the revised SPM. For instance the figure SPM.4 now includes a panel on N2O emissions.
99981	21	20			We thank the authors for their hard work and dedication. With respect to Box SPM.2 Table 3, we are recommending that it be removed from the SPM as we cannot ascertain the message it which to relay with respect to remaining carbon budgets. Providing the cumulative CO2 emissions at certain temperature thresholds is very confusing and misleading (SSP3-7.0 vs SSP5-85). These numbers could be interpreted that there is more 'time' left under SSP5-85. With section D.1, there is an entire SPM section dedicated to the remaining carbon budget. We recommend that this very sensitive and policy relevant information be kept in one place and recommend that the authors attempt to refrain from including cumulative CO2 estimates for temperature thresholds that may introduce confusion to policy makers. [Caroline Eugene, Saint Lucia]	Taken into account. Table removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68803	21	20			Box SPM2 Table 3 fails to relay the right message with respect to remaining carbon budgets. Providing the cumulative CO2 emissions at certain temperature thresholds is very confusing and misleading (SSP3-7.0 vs SSP5-85). With section D.1, there is an entire SPM section dedicated to this topic. Remaining carbon budget is very sensitive and policy relevant but must be kept in one place and refrain from including cumulative CO2 estimates for temperature thresholds that introduce confusion. [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Table removed from revised SPM.
44771	21	22	21	22	"Numbers... from the scenario data base." is unclear and could be deleted. [Markku Rummukainen , Sweden]	Not applicable. Table removed from revised SPM.
54659	21	22	21	24	Box SPM.2 Table 3: Similar to comment on table 1, the statement that results in column 6-9 are for human-induced warming and do not include the uncertainty from natural variability needs further explanation. [Nancy Hamzawi, Canada]	Not applicable. Table removed from revised SPM.
27899	21	24	21	25	We recommend to add the likely range due to model uncertainties. [Eric Brun, France]	Not applicable. Table removed from revised SPM.
54661	21	27	21	27	Recommend adding a line to the end of this Table caption to note that the two lowest scenarios project significant amounts of global net negative emissions with a cross-reference to Box SPM.2 Figure 1. This is needed to alert readers to how to interpret (for example) the decrease in cumulative emissions from year 2050 to year 2090 for SSP1-1.9. [Nancy Hamzawi, Canada]	Not applicable. Table removed from revised SPM.
8149	21	28	21	28	It is not intuitive to understand what is the meaning of cumulative carbon emissions at the temperature threshold (columns 9). I assume the different carbon emission numbers are determined by the impact of other forcings in the scenarios. If so this can be included in the table header. [Frank Dentener, Italy]	Not applicable. Table removed from revised SPM.
81897	21	28	21	28	Unclear what emissions "relative" to 2015 means. Is it emissions "since" 2015? Also not clear whether/how non-CO2 gases are included. If not, what role do they play? [Dan Zwart, New Zealand]	Not applicable. Table removed from revised SPM.
131733	21	28	22	1	As a non-expert I would appreciate a guide on how to read this table. It would be really helpful, if you could add one paragraph below the table, describing in a few explaining sentences - a.g. for SSP2-4.5 - on how to decode or "translate" in the information given in the table. [Hans Poertner and WGII TSU, Germany]	Taken into account. Table removed from revised SPM.
109515	21	28	22	1	I would have expected Table 3 here to show uncertainty range for the cumulative emissions compatible with the CO2 concentration pathways used to simulate warming and sea level rise presented in Tables 1 and 2 above. [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table removed from revised SPM.
10197	21	28	22	1	Clearer explanation needed for why the cumulative carbon emissions differ substantially for 1.5°C between SSP1-1.9 and others [Robert Kopp, United States of America]	Not applicable. Table removed from revised SPM.
50513	21	28	22	2	Box SPM.2 Table 3 row 1 column 1: GtCO2 is used here for emissions, but Chapter 5 uses PgC. Please either be consistent or provide a footnote on how map between the different units. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. The conversion between the two units is shown in the technical summary. GtCO2 is the unit for consistent use in the SPM.
131735	21	28			What is the number for the baseline 2015? [Hans Poertner and WGII TSU, Germany]	Taken into account. Table removed from revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27901	21	28			Regarding Box SPM.2, Table.3: line 1, column 3: why not give the 2030 value and the range between 2021-2040 as is done for temperature values? The apparent 'non linearity' for this time period between the change in GSAT and the change in cumulative carbon emissions can be dampened if you provide a range. [Eric Brun, France]	Not applicable. Table removed from the SPM.
81273	21		21		The decades/years chosen fro SLR estimates, carbon emission, etc. are inconsistent. If you want the tabulated values used in the future, put in every 10-20yrs in the 21st century at the very least for these key metrics. Also, check how they compare to the IPCC SROCC report findings for SLR. [Stephanie Downes, Australia]	Taken into account. Table 2 (which is really meant) no longer appears.
17485	21				Box SPM.2, Table 2: For mid-term and long-term the years (2050 and 2090) are the middle of these time periods. For near-term it is 2040 - the end of the range. If this is intentional, it probably needs to be explained. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table 2 (which is really meant) no longer appears.
17487	21				Box SPM.2, Table 3: 'best estimate only' probably needs further explanation. To a non-specialist it sounds quite arbitrary/a guess. If this is the first time that IPCC has given a 'best estimate', it is perhaps also worth highlighting. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table 3 (which is really meant) no longer appears.
17489	21				Box SPM.2, Table 3: it would be helpful to have column numbers given that these are referenced in the text. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table 3 (which is really meant) no longer appears.
17491	21				SPM.2, Table 3: If it were possible to include some sort of reference number (possibly Cumulative Carbon Emissions from a previous period), it could help provide context and help the reader better understand the significance of these numbers. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table 3 (which is really meant) no longer appears.
110993	21				Box SPM.2, Table 2: For mid-term and long-term the years (2050 and 2090) are the middle of these time periods. For near-term it is 2040 - the end of the range. If this is intentional, it probably needs to be explained. [Monica Dean, United States of America]	Not applicable. Table removed from the revised SPM.
110995	21				Box SPM.2, Table 3: 'best estimate only' reads as an arbitrary guess to a non-specialist. [Monica Dean, United States of America]	Not applicable. Table removed from the revised SPM.
110997	21				Box SPM.2, Table 3: it would be helpful to have column numbers given that these are referenced in the text. [Monica Dean, United States of America]	Taken into account. The term 'best estimate' no longer appears in the revised SPM.
109513	22	1	22	1	Please include an additional table showing the CO2 concentrations in the SSPs at the times and global warming levels in tables 1 to 3 in Box SPM.2 [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. We have tried to remove (not add) tables from the SPM, to shorten the document.
42031	22	5	22	5	BOX SPM.2 FIG.1: In the left panel, please, consider moving symbols for reaching warming levels (open circles) on top of panel to the corresponding scenario-curves, e.g. using different symbols for different warming levels (1.5; 2.0; 3.0; 4.0). [Juhani Damski, Finland]	Not applicable, this information has been removed from the final figure to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ from one driver to another but future CO2 emissions dominate the future total warming.
42247	22	5			Box SPM2, Figure 1: Add RCP-scenarios as dashed lines for comparison to AR5? [Tina Christensen, Denmark]	Rejected, for sake of clarity, only the SSP trajectories are shown as the intent of the figure is to highlight the diversity of the emission trajectories assessed in the WG1 report and, for each scenario, the different trajectories for various contributors.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42251	22	5			Box SPM2, Figure 1, right panel, median appears missing on SSP1-1.9; and missing description of the uncertainty intervals shown on the right panel. [Tina Christensen, Denmark]	Taken into account, the final SPM4 figure shows uncertainty intervals and median for each scenario..
28123	22	5			Regarding Box SPM.2 Figure.1: - The timing to which certain temperature levels are reached in the various scenarios should better be displayed below the figure, under the x-axis representing years. - Also, for better understanding, the + sign should be added in front of the numbers on the y-axis of the second graph. - Concerning the second graph : are the bars 90% range? If the results are not raw model outputs but ranges of possible temperature outcomes, then we would strongly advocate for showing 2050 and 2100 temperature levels rather than T change for 2041-2060 and 2081-2100 (with the latter being significantly less than 2100 temperature change for the high end scenarios). Isn't what policymakers would be interested in? [Eric Brun, France]	Taken into account, the information about the timing has been removed from the final figure to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ from one driver to another but future CO2 emissions dominate the future total warming. The definition of the range is clarified in the caption. The 20 year means have been kept to be consistent with the other figures and Tables shown in the SPM.
81841	22	7	22	10	These first four lines of the caption sit above the caption as a separate purpose statement when the figure is presented on page 51. It is quite useful to have such a purpose statement as it helps to understand what the figure is trying to illustrate. A matter of presentation, not substance. [Dan Zwartz, New Zealand]	Not applicable, these sentences were only there for SOD version because the figure was still in its design process.
36159	22	7			Please come up with a less confusing figure labeling for the boxes than this. It confuses the major figure SPM.n with these box figures and tables that sound higher level, being just figure.n (if one does not keep saying "Box nn". Perhaps Figure Box.1? [Michael PRATHER, United States of America]	Taken into account, the figure labelling has been simplified in Figure SPM4 in the final SPM version.
36161	22	7			It is important to show here the offset caused by non-CO2 (incl N2O!). This is misleading. In AR5 (as well as the final Figure here), it is clear what the offset is. In this discussion, you have buried that fact. It is important to see how much these scenarios deviate from cumulative-CO2 due to other ERFs. [Michael PRATHER, United States of America]	Taken into account, the final figure SPM4 now shows the emission trajectories for a subset of non-CO2 and the effect of changes of CO2 vs non CO2-GHGs vs aerosols+Land use are shown in addition to the total effect of emission changes on global surface temperature.
108197	22	12	22	21	Is "radiative forcing" defined in plain language for the readership of this chapter? [Anton Holland, Canada]	Not applicable, the term or its acronym are not used on the final figure SPM4.
42249	22	14	22	17	Box SPM2, Figure 1, caption L14-17: "multiple lines of evidence" - could it be specified what these cover? [Tina Christensen, Denmark]	Not applicable, not said anymore in the caption of the final figure (SPM4).
44773	22	15	22	17	This (Note that... outcomes.) is rather vague. Suggest rewriting or omitting the detail that should be available via the chapter references. [Markku Rummukainen, Sweden]	Not applicable, not said anymore in the caption of the final figure (SPM4).
97301	22	15			What is „raw“ model output, will it be „cooked“ at some point? [Nicole Wilke, Germany]	Not applicable, not said anymore in the caption of the final figure (SPM4).
26345	22	16	22	16	(medium confidence).. -> Two dots [María Santolaria-Otín, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
130057	22	18	22	18	[ENSEMBLES] Authors need to define how they developed, or what they consider, the 'baseline'. [Trigg Talley, United States of America]	Taken into account, the term "baseline is not used anymore to refer to the 1850-1900 period.
27903	22	19	22	19	A verb or something else is lacking in this sentence. What is the purpose of this sentence? [Eric Brun, France]	Taken into account, caption fully rewritten in final version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50255	22	Table	22	Table	Comparing this table with SPM2 Table 1: CO2 emissions budget for 1.5 lower for RCP8.5 than RCP4.5. So can we assume that if 1.5 warming later under 8.5 c.f. 4.5. (as suggested in Table 1) then it's the aerosols that are lagging the warming response? This should be made clear. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Box SPM.2, Table 3 removed from revised SPM.
86573	22		22		Box 2 Table3. 1) Why is the remaining C budget for reaching 1.5C so much lower for SSP1-1.9 than for any other scenarios? It doesn't make much sense as C budget are (supposedly) largely scenario independent. Also counter-intuitive (again) that SSP1-19 gives a lowest estimate. Is SSP1-1.9 also based on CMIP6 ESMs or is it based on emulators only? Are these numbers comparable ? 2) It doesn't look like these numbers are comparable to the ones given in Table SPM3 (ex. all 2°C numbers are well above the ones given in Table SPM3). 3) Do we really need to know the carbon budget for 4°C ? ... [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table removed from revised SPM.
66445	23	1	23	1	It seems like "Future changes to the Biosphere" is missing from this list of C.x topics. [Charles Koven, United States of America]	Noted. Section introduction has been shortened.
34535	23	1	23	1	There is substantial variability across the "Our possible climate futures" section in terms of how much SSP-specific detail is provided. For instance, C.1 has much more information about particular SSPs than does C.3 and C.4. [Russell Vose, United States of America]	Taken into account. We have tried to harmonise the details provided about specific SSPs.
108267	23	1	23	1	I suggest to drop the "our" [Johannes Quaas, Germany]	Deleted in the approved version.
77015	23	1	23	8	The preamble should be revisited in the context of the narrative of the report: how does it build on what has been provided and what are the limits and constraints being considered. For example this may include the Paris Agreement temperature goal. [Emer Griffin, Ireland]	Taken into account and re-written.
111371	23	1	24	47	needs more info for policymaker to understand [Neeshad Shafi, Qatar]	Taken into account and re-written.
31801	23	1	28	53	In my understanding I find the information here not coherent to draw a strong conclusion regarding the possible futures and for decision making. This is due to a lack of information regarding the timing to which the changes are presented in most of the statements made. I think it should be made explicitly if it is either presented for Global Warming Levels or in time horizons (near-term (2021-2040), mid-term (2041-2060) and long-term (2081-2100). Or this information is not supposed to be in the SPM? Also in many statements only the direction of change is presented and I think the magnitude of the change together with the timing of the change is critical information for adaptation and mitigation strategies! [Izidine Pinto, South Africa]	Taken into account and re-written; warming levels no longer appear in the section introduction.
97303	23	1	29	6	Please include in sections C.3 - C.4 information about the future shift of climatic zones (temperature, precipitation, and with them ecosystems) in response to regional warming pattern, dependent on the level of global warming/scenarios. Such information could feed into the WG II report and is highly relevant for policy makers. [Nicole Wilke, Germany]	Rejected due to space limitations although Figure SPM.5 presents some information on changes to temp, precipitation and drought at 3 global warming levels.
90187	23	1	38	18	While we generally appreciated the combined approach of scenarios including radiative forcing levels in combination with SSPs scenarios as they allow combining climate policy with a range of other policies, we consider that the naming of the scenarios should be reviewed in conjunction with communication experts. E.g., scenario SSP1-1.9 could be referred to as "lowest assessed emission scenario". [Georges Gehl, Luxembourg]	Taken into account. Consistent labelling and reference to the SSP scenarios has been introduced, including a more descriptive label such as 'very high co2 emissions'.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104167	23	1	38	18	We propose including a subsection in Section C to consolidate the main findings related to land. This is mainly a question of re-organisation to consolidate the major land-related findings, most of which are already in this SPM draft (e.g. on permafrost thawing (several places), wildfires and evolution of the terrestrial sink (C1.5). The following statement from Chapter 5 could also be included in the SPM since it is highly relevant for non-experts and policymakers: Of the total anthropogenic CO2 emissions, the combustion of fossil fuels was responsible for about 81–91% and the remaining from land use change (e.g., deforestation, degradation, peat drainage). {5.2.1, Table 5.1} [Philippe Tulkens, Belgium]	Not applicable. The narrative of new section 'climate future' (former section C) has been completely revised and the headline statements are not sorted by component of the climate system anymore.
14565	23	2	38	18	SPM C attempts to mix projections by warming level and projections by scenarios which will be very confusing to the average policy maker. In the preamble it is stated that "While scenarios have a long history in IPCC, global warming levels are also useful". Agree, but this implies that, as in other ARs here too the main projections will be given by scenario while projections by warming level are also given as a value addition. However, this is not how it appears in the main text of SPM C. In fact, if one looks closely, much of the future projections in SPM C ARE by scenario (C2.4, C2.5, C3.3, C3.5, all of C4, C5.2, C5.6, BOX SPM 3 and not by warming level (especially when one takes into account the plethora of projections given by scenario in SPM BOX 3). While projections by warming level will be very interesting for those involved in mitigation (i.e. WGIII), for adaptation (WGII), most practitioners still find projections by scenario to be more useful (to help them make on-the-ground decisions). Also for readability it would help greatly if projections by scenario and projections by warming level were to be given in two completely different subsections within SPM C. Mixing of these two types of projections fails to provide clear and useful information to the average policy makers who have to make real-life adaptation decisions (with price tags of hundreds of millions of euros per adaptation measure) at local to regional scale. [Roshanka Ranasinghe, Netherlands]	Taken into account. Although the FGD SPM retains the use of both scenario and global warming level information, efforts have been made to present results in a more traceable manner to the underlying chapters. For example, crossing times of global warming levels and how this correspond to the SSPs are covered in HS5 and Table SPM.1.
50263	23	3	23	3	Suggested edit: 'Climate projections explore a subset of possible futures focused around/on different human-induced emission pathways' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Sentence removed from section introduction.
90767	23	3	23	3	Delete the word "Preamble" because it introduces an essential ambiguity in the SPM. For policymakers, the word Preamble in a document means that it is not an "operative" or "executive" part of the document, and therefore that it can be treated as a "nice to have" but not a necessary part of the document. On the other hand, SPM is, by definition, a document where every statement has a high scientific content and nothing is "preambular" in nature. All SPM is "operational" or "executive" and nothing is preambular. [José Romero, Switzerland]	Accepted. 'Preamble' removed from section introductions.
44775	23	3	23	3	"Subset" sounds less than what it is about - a rather extensive set in the sense that a wide range of possible cases is covered, and the overall result very probably contains the actual future". Rewrite? [Markku Rummukainen, Sweden]	Accepted and reworded.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32369	23	3	23	7	The phrase "more comprehensive Earth System Models" in connection to the simple emulators feels a bit as if the ESMs were somewhat better than the emulators, while in fact they are advanced process-based models. In the current formulation the complexity and power of ESMs might thus be lost. What about calling them "advanced Earth System Models"? [Clemens Schwingshackl, Norway]	Taken into account. We now say 'complex Earth system models'
38289	23	3	23	46	Similar expressions such as global mean surface temperature, the global temperature, global mean surface air temperature, global surface air temperature warming and global warming appear in this section from PREAMBLE to the last paragraph. In order to enhance the accuracy of the report and avoid confusion, it is suggested to check the use of this important concept uniformly, not limited to this paragraph. Verifications and modifications by the author team are highly suggested. [Yaming LIU, China]	<p>Taken into account.</p> <p>Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
80121	23	4	23	7	We have way better methods than simple emulators, maybe it is not worth mentioning it in the preamble. Scenarios and global warming levels are not comparable, the latter one is the result of the scenarios. [Lilian Fejes, Hungary]	Taken into account and re-written; emulators and warming levels no longer appear in the section introduction.
78619	23	4			GMST? Or GSAT – need to be careful which. Presumably GSAT for projections. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	<p>Not applicable.</p> <p>Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
36163	23	4			This is too simplistic. The scenarios must include LULUCF, impacts on hydrology and albedo - no? It is "human activities that drive the climate system" ? [Michael PRATHER, United States of America]	Accepted and expanded.
65589	23	5	23	5	Suggest also add that climate models and scenarios today are substantially more sophisticated. [Kushla Munro, Australia]	Taken into account; comparison to AR5 now made.
50265	23	5	23	5	Suggested edit: While scenarios have a long history in the IPCC of illustrating possible future impacts drivers at particular time intervals, global warming levels are also useful...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account and re-written; warming levels no longer appear in the section introduction.
131737	23	5	23	5	Consider rephrasing/explaining "emulators", many policymakers might not understand [Hans Poertner and WGII TSU, Germany]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86575	23	5	23	7	Unclear, it reads like global warming levels estimates are not based on scenarios. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account and re-written; warming levels no longer appear in the section introduction.
104169	23	5	23	7	It is unclear what the second sentence (in particular the first clause: "While scenarios...") is trying to convey. [Philippe Tulkens, Belgium]	Taken into account and re-written; warming levels no longer appear in the section introduction.
111469	23	6	23	6	"irrespective" [James Renwick, New Zealand]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
97305	23	6			Please explain what "global warming levels" are, since they can also be obtained from scenarios. What is the consequence of neglecting path aspects dependencies, stabilisation, or overshoot? [Nicole Wilke, Germany]	Taken into account and re-written; warming levels no longer appear in the section introduction.
81843	23	6			"irrespective" [not "irrespectively"] [Dan Zwart, New Zealand]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
132617	23	10	23	10	I think this section could do with some reorganization. After C.1.1. should come an assessment of ECS and TCR and their values in CMIP6 models (C.1.6 and C.1.7). The reason is that unlike previous assessment reports the assessed ranges of ECS and TCR are used to constrain projected warming. The assessment of ECS and TCR thus naturally comes after the assessment of feedbacks and before the assessment of projected warming (C.1.3). [Kyle Armour, United States of America]	Taken into account/not applicable. The entire SPM has been reorganised and climate sensitivity is now covered in HS4 (while TCR is no longer mentioned in the text, for brevity and clarity).
31455	23	10	23	47	This section is overall well written, but some re-ordering of statements might be effective. Current stream is to start from climate feedbacks (C.1.1), and then warming in projections (C.1.2) to the warming level to which estimates of ECS/TCR are relevant (C.1.3). I suggest swapping C.1.2 and C.1.3 as the feedbacks are directly connected to ECS/TCR, which give the physical basis for the level of warming in different future scenarios. [Masahiro Watanabe, Japan]	Taken into account. The section has been significantly revised: C1.1. has been removed but the revised versions of C1.2 (now HS5.3) and C1.3 (now HS5.1) have been swapped.
90189	23	10	24	43	This section would need to be rewritten, to take into account our general comment on the temperature re-assessment, which we would like to repeat here. This shift also has implication for projections. In the SR1.5 the projections with lowest emissions trajectories, stayed just below 1,5°C and were qualified as "no-overshoot" scenarios. This seems to us not being the case anymore in the AR6 but is left completely uncommented in the SPM. Can you confirm that all projections in AR6 need to be considered now as "overshoot scenarios"? This has also a direct implication on one of the main messages coming out of SR1.5, namely that limiting global warming to 1,5°C was still possible. With the re-assessment it seems that this message does not hold true anymore and this should made clear in the SPM, including why the assessment of this message has changed in the three year since the publication of the SR1.5. Finally, we think that the SPM would highly profit from a discussion of the impact of this re-assessment on the Paris Agreement temperature targets, which is done in subsection 2.3.1.1.3 and the main messages of this discussion should be include in the TS and the SPM. Also we strongly urge the authors, to include references to the AR5 and SR1.5 temperatures, and explanations how assessment have changed, so as to make it fully transparent how one can compare results from these different reports. [Georges Gehl, Luxembourg]	Taken into account. Text now addresses overshoot in SSP1-1.9 and connects to AR5 and SR1.5. However, it would be confusing to the readers to present two parallel assessments.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90191	23	10	24	43	We also would like to re-iterate our general comment on the reaching of 1,5°C around ten years earlier than in the SR1.5, which needs to be more clearly explained: Given the importance of when 1,5°C of global warming will be reaching in the framework of the Paris Agreement, we are surprised that the AR6 assesses that 1,5°C is reached about 10 years earlier than was assessed in SR1.5 without giving a clear indication of what this reassessment is based on. We have several issues with this assessment. First the reason given in the TS "the provision of enhanced estimates of the historical observational record" (L11-12) seems a bit simplistic for the communication of such an important result. Second when digging deeper in the chapter we went to read CH4.3.1 as well as CH2.3.1 and found that the AR6 uses a value of 0,99°C of increase of GSAT for the period 1880-2012, which is significantly higher than the 0.85°C GMST used in the lead up to the PA and underlying the decisions taken in this Agreement. We however were not able to find a clear explanation of this important change neither in text nor in Table 2.4. We strongly recommended the authors to give a clear and accessible explanation of this change given its policy relevance. Finally, we are not convinced that the value of 2030 to reach a warming of 1,5°C is consistent with the current warming rate. Starting from a value of 1,1°C GSAT for current warming and a warming rate of 0,2°C/decade, we would rather have a range of 2029-2038 for reaching 1,5°C including the uncertainty indications. We would thus expect rather a value around 2035 and we strongly urge authors got give an explanation while they assume that the value of 2030 is more appropriate. [Georges Gehl, Luxembourg]	Taken into account. Text has been completely rewritten, taken care of all perceived inconsistencies mentioned here. .
553	23	10	25	18	This chapter will be essential for Policy makers. I recommand to add one set inofrmation: in 2015 during COP21 in Paris, It was stated that the INDC provided before the COP21 by the differnt states would lead - if actually implemented- to a temperature increase of 3,2°C. As result, the COP21 concluded that additional efforts had to be made to target 2°C, and even 1.5°C. It should be interesting to know if the initial INDC have actually been enforced? by wchich countries? have they be revised? if yes, what is the targeted temerature increase, etc.. This information would give a very concrete manner the results of the policies actually enforced, which is most likely very different of what is heard in official speeches! [Michel SIMON, France]	Rejected. It is beyond the mandate of WGI to assess the current NDCs in the Context of the Paris Agreement
27905	23	10			The Glossary uses the concepts of constant emissions / composition / net zero commitments. These are very informative concepts and easy to understand. It would be useful to include in the SPM the various commitments to which we are today. [Eric Brun, France]	Taken into account. The revised SPM now clarifies what changes are committed due to the geophysical response (H.S.9). The detection of changes is now covered in HS.14. Committed changes across scenarios are shown in Figure SPM.8. Associated emission commitments across scenario is the mandate of WGIII.
42657	23	10			In this para it would be useful to include a comparison with the projected warming from AR5 (at least for 2.6 and 8.5 scenarios). It will be difficult for policy makers to make this comparison because of the changed reference period and the use of surface air temperature in AR6. Useful to make it explicit. How the warming figures compare with AR5 will be of key interest. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Space constraints prevent that level of technical detail here, for which the TS and the chapters are the right place.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
5289	23	10			Section...I suggest that discussion of the SSPs be absolutely minimized. This goes with my theme that the SPM should be written for policymakers rather than using IPCC technical language. I invite you to step out into the role of an outside reader and compare the readability of C.2.3 and C.2.4 as currently written: "If global warming remains below 2 C ... the Arctic Ocean will likely remain partly sea-ice covered..." Anybody can understand that. In contrast, "The Greenland ice sheet will contribute 0.07 m and 0.13 m...under SSP1-2.5 and SSP5-8.5, respectively." Only an expert can understand that. The SSPs are inevitably very, very technical. It may not be possible to completely eliminate discussion of them, but push as much as possible to the technical summary. I like that figure SMP.8 uses global mean temperature change rather than SSPs. [Daniel Murphy, United States of America]	Taken into account. Every effort has been made to simplify the language; however, in many places explicit mention of the scenario is essential, because many projection statements are conditioned on a specific scenario, and this must be unambiguous.
9731	23	12	23	12	don't understand "significant progress from observational and paleoclimate constraints" [Jonathan Lynn, Switzerland]	Taken into account. Sentence removed from revised headline statement (HS5).
77557	23	12	23	12	The meaning of "observational and paleoclimate constraints" may not be clear to the reader of the summary for policymakers [Emer Griffin, Ireland]	Taken into account. Headline statement has been simplified substantially.
42235	23	12	23	13	C1 Headline statement L12: Opening sentence is hard to read. Should be rewritten. E.g. what is 'progress from obs and paleo constraints'? [Tina Christensen, Denmark]	Taken into account. Headline statement has been simplified substantially.
78621	23	12	23	15	Suggest drop first sentence – more preamble than content. Start with the actual result you want to communicate: "Global warming of 1.5..." [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed from revised headline statement (HS5).
42033	23	12	23	15	The first sentence should be removed from the headline statement. [Juhani Damski, Finland]	Taken into account. Sentence removed from revised headline statement (HS5).
81899	23	12	23	15	The first sentence is very long and wordy. Would be better if the key statement was first in its own sentence (e.g. "Since AR5, significant progress has been made in assessing the temperature response to future radiative forcing resulting from human activities. This progress is the result of improved observational and paleoclimatic constraints, together with...") [Dan Zwart, New Zealand]	Taken into account. Headline statement has been simplified substantially.
104171	23	12	23	15	C1 This is already established in sections A & B [Philippe Tulkens, Belgium]	Taken into account. Headline statement has been simplified substantially.
90193	23	12	23	21	This headline statement needs to be reformulated to take into account the comments made to the implications of the temperature re-assessment, namely to include clear messages to policy-makers if the AR6 assesses that limiting global warming to 1.5°C is still possible or not and the main reasons why the 1.5°C is reached around 10 years earlier in AR6 compared to SR1.5. The other message which should be included is the following "The assessed likely range of global mean surface air temperature over the period 2081–2100 is very likely to correspond to anomalies of 1.2°C-1.8°C compared to pre-industrial climate for SSP1-1.9, and of 2.9°C-4.7°C for SSP3-7.0." with more accessible names for the scenarios. [Georges Gehl, Luxembourg]	Taken into account. Headline statement has been simplified substantially. Comparison to SR1.5 on reaching 1.5°C of global warming has been added, although not to headline statement. In many places explicit mention of the scenario is essential, because many projection statements are conditioned on a specific scenario, and this must be unambiguous.
50257	23	12	23	21	Suggest C1 also mentions that regional/local changes are also important for impacts and uncertainties remain there too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This would overburden the headline statement.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50259	23	12	23	21	<p>The finding "Global warming of 1.5°C, neglecting the influence of natural internal variability is estimated to occur around 2030, across all scenarios in this report" is a significant departure from the conclusions of SR1.5 which stated that "global warming is likely to reach 1.5C between 2030 and 2052 if it continues to increase at the current rate." (A1 SPM SR1.5) and the finding in SR1.5 that it is possible to limit global warming to 1.5. It is very important that the SPM clarifies why we now think that we will reach 1.5C so significantly sooner than previously estimated - for example, is it because of the switch from GMST to GSAT? Is it due to the use of CMIP6 models, around which there is considerable uncertainty about ECS? Is it due to improved understanding of historical warming?. If it is indeed still possible to limit global warming to 1.5C without overshoot, as could be inferred from the carbon budgets analysis found in chapter 5 of the report, and by the latest mitigation evidence from IAMs, this should also be clearly stated.</p> <p>In all cases, it would help the reader if consistency on that aspect could be improved across chapters. For instance, section 5.5.2.3 of chapter 5 about "remaining budget overview" and especially table 5.8 (assessed remaining carbon budget and corresponding uncertainties) suggests positive remaining carbon budgets before reaching an increase of temperature of 1.5C., an aspect also reflected in the summary of chapter 5 without any reference to ZEC. If a key explanation is that one needs to use the upper range of ZEC already on decadal time scales in the context of low-emissions scenarios (section 5.5.2.4 suggests "ZEC is considered for a time frame of half a century"), it would be useful to bring that clarification in section 5.5.2. and in the summary of chapter 5. [If the comparison with CMIP6 results requires the introduction of a wider range of differences in key assumptions, discussion of figure 5.31 (maybe with the addition of a low emission scenario from CMIP6 in addition to SSP5-8.5) could be</p>	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added. A positive remaining carbon budget is consistent with the SOD SPM statements.
9629	23	12	23	21	<p>I have a strong feeling that the upper range for the GSAT estimates is too conservative in light of some CMIP6 models. I think much more weight should be put on observational constraints rather than paleoclimate constraints and this should be done on individual model members rather than ensemble means. More comments on this in the underlying chapters. [Olivier Boucher, France]</p>	Rejected. The recent literature on constraining the CMIP6 models applies to the ensemble rather than individual models, and it is based on instrumental, not paleo-observations. Furthermore, the assessed GSAT change explicitly incorporates the updated assessment of ECS and TCR. The results of the widely varying approaches are consistent with each other. No change.
5291	23	12	23	21	<p>I think the concept that global warming is closely related to cumulative CO2 emissions belongs in this red box. It is one of the most important concepts for policy makers to understand. It also never quite gets stated in this bullet points, with C.1.4 immediately jumping to the linearity of the relationship. Policy makers need a clear statement that the single most important factor determining long-term climate change is the cumulative emissions of CO2. [Daniel Murphy, United States of America]</p>	Taken into account and clarified now in Section D.1 of the final (approved) SPM.
86967	23	12	23	21	<p>This is a very policyrelevant highlighted conclusion. It is maybe a little to long, so please consider if the first sentence is necessary, or if this could be refelcted in the underlying associated bullets. If retained it might be better to end the highlighted conclusion with the progress made since AR5, since the rest of the conclusion is in our view most policy relevanyt. [Oyvind Christophersen, Norway]</p>	Taken into account. Headline statement now simplified.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20935	23	12	23	21	Different metric have been used to quantify warmin eg. GSAT and GMST. The Global warming of 1.5 is it GSAT or GMST? [Ladislav Chang; a, United Republic of Tanzania]	Noted. Following the SOD review, changes in GSAT and GMST were reassessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
77017	23	12	23	21	The full Paris Agreement temperature goal should be addressed here. [Emer Griffin, Ireland]	Taken into account. Both 1.5°C and 2°C are now addressed in the headline statement.
77019	23	12	23	21	Linking the radiative forcing to the perturbation of the global energy balance/imbalance/budget in a simple manner would aid clarity. [Emer Griffin, Ireland]	Rejected. This would overburden the headline statement.
77021	23	12	23	21	Use another word for anomalies. We are referring to temperature increment as warming here so similar levels communications should be used [Emer Griffin, Ireland]	Accepted. "Anomaly" no longer used in SPM.
77023	23	12	23	21	Use other words for SSPs here; these can be developed in the unlying text for this section [Emer Griffin, Ireland]	Rejected. In many places explicit mention of the scenario is essential, because many projection statements are conditioned on a specific scenario, and this must be unambiguous.
114935	23	12	23	21	I commend the authors to have chosen SSP3-7.0 as high case for the situation in which only a single low and a single high case is reported. This is the right choice and should be made consistently in the SPM. I am writing this as lead author of the paper that published the SSP5-8.5 scenario. The scenario is a counterfactual baseline scenario and was conceived as such. It deliberately includes no climate policy. Since we already have seen some amount of climate policy on the ground, an SSP5-8.5 scenario is highly unlikely to come about in the real world. It is therefore the better choice to present SSP3-7.0 as the upper end of how warm it could get if no additional(!) action is taken in the future. [Elmar Kriegler, Germany]	Noted, although this preference is not shared by many, as the numerous comments show that criticise the singling out of SSP3-7.0. WGI cannot assess the degree of realism of the scenarios upon which the assessed literature is based.
130455	23	12	23	35	For 1.5C level timing, if different from SR15, should be cautious; if the same, why reiterate here? [Panmao Zhai, China]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
34991	23	12	23	35	The SOD predicts a GSAT of 1.5°C relative to 1850-1900 by 2030 under all scenarios. Based on current observations and trends, it is implausible envisage a temperature increase of 0.4°C within a decade beyond the current claimed 1.1°C. Please see general comments #1, #2 and #3 above. [Jim O'Brien, Ireland]	Noted. The comment fails to appreciate that we are considering a 20-year period here. No change.
130059	23	12	24	42	Understanding feedback loops and potential "tipping points" in the climate system will be very important for determining how and where the most extreme climate threats come from. [Trigg Talley, United States of America]	Noted
112161	23	15	23	15	Global warming of 1.5°C [Timothy Carter, Finland]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87333	23	15	23	15	insert: The estimated equilibrium temperature response of the climate system to an increase of greenhouse gas concentrations levels has somewhat increase compared to AR5, with an best estimated of 3 degrees for a doubling of the concentration. [Marcel Berk, Netherlands]	Taken into account. ECS is dealt with in HS4.
86577	23	15	23	15	As mentioned before reaching 1.5°C in 2030 implies a warming of 0.4°C in 10 years. Twice as large as the current rate of warming... [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The comment fails to appreciate that we are considering a 20-year period here. No change.
67647	23	15	23	15	put "of" before 1.5C [Karen Rosenlof, United States of America]	Accepted
26177	23	15	23	15	"relative to preindustrial era" should be added after "1.5°C". [Toshihiko Takemura, Japan]	Taken into account. Text completely rewritten.
50267	23	15	23	15	Typo: Global warming of 1.5C...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
86117	23	15	23	15	"neglecting the influence of natural internal variability" – what does this mean? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Uncertainty from internal variability is now included (covered in chapter text).
111471	23	15	23	15	"global warming of 1.5C" [James Renwick, New Zealand]	Accepted
90769	23	15	23	15	Write: "Global warming of 1.5°C, neglecting ... ", as in the SR on Global Warming of 1.5 degrees. [José Romero, Switzerland]	Taken into account. Uncertainty from internal variability is now included (covered in chapter text).
87463	23	15	23	15	Missing word: 'global warming OF 1.5C' [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
20933	23	15	23	15	Add "of" after glbal warming. To read "Global warming of 1.50C [Ladislaus Chang'a, United Republic of Tanzania]	Accepted
78281	23	15	23	15	Global warming of 1.5oC [Leonie Lee, Singapore]	Accepted
44777	23	15	23	15	The "neglecting... variability" is of course valid, but may be unnecessary detail, not least if this means that the forced trend effectively takes the world to 1.5 by 2030. Or rewrite for greater clarity. [Markku Rummukainen , Sweden]	Taken into account. Uncertainty from internal variability is now included (covered in chapter text).
104173	23	15	23	15	Replace "Global warming 1.5°C" with "Global warming of 1.5°C" [Philippe Tulkens, Belgium]	Accepted
77559	23	15	23	15	"Global warming 1.5°C, neglecting the influence of natural internal variability..."; The bassline period should be made clear. Mentioned below in the context of end-of-century projections but should be mentioned in the first instance. [Emer Griffin, Ireland]	Taken into account. Text completely rewritten.
69377	23	15	23	16	Regarding C.1, if the estimation on global warming 1.5°C around 2030 is to be illustrated as a key message, given that the message will have a large impact on social activities, it would be requested that the uncertainty associated with the estimation, as well as the comparison between the figures and assessment methods of SR1.5 and this WG1 SOD, be clearly stated to avoid confusion. In addition, with such a major impact of this estimation on climate activities and players, the fact that it only entails medium confidence needs to be clearly stated in the table itself, rather than as a note. [Kaoru Magosaki, Japan]	Taken into account. Text completely rewritten.
7685	23	15	23	16	It is suggested to insert "of" before "1.5°C". [Klaus Radunsky, Austria]	Taken into account. Text completely rewritten.
9733	23	15	23	16	The conclusion "Global warming of 1.5°C... is estimated to occur around 2030, across all scenarios assessed in this report" needs careful preentation otherwise it will be picked up as "IPCC says only 9 years left to stop global warming" or similar cf the "IPCC says 12 years left to save the planet" from SR15 [Jonathan Lynn, Switzerland]	Taken into account. Text completely rewritten. One of the aims was to avoid pinning change to a single year.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130061	23	15	23	16	Suggest to remove the parenthetical statement about neglecting the influence of natural internal variability since it undercuts the effect of the opening statement of the sentence. Revise as follows: "Global warming of 1.5°C relative to preindustrial climate is estimated to occur around 2030 across all scenarios assessed in this report (medium confidence)." [Trigg Talley, United States of America]	Taken into account. Uncertainty from internal variability is now included (covered in chapter text).
65581	23	15	23	16	Suggest authors bring forward relevant detail that is included in Chapter 4 to explain that this temperature level is expected to be reached earlier than previously thought, as reported in the Special Report, Global warming of 1.5°C, and an explanation of why there is such a large difference since the 2018 assessment. [Kushla Munro, Australia]	Taken into account. HS5.3 is mentioning the 10 yr earlier crossing time and where the difference between SR1.5 and AR6 comes from.
65583	23	15	23	16	Suggest the authors bring forward relevant material from Chapter 4 in order to include a statement in relation to an estimate of when 2°C is expected to be reached. Suggest the authors carefully align the evidence presented in SPM2 Table1 with the SPM statement as well as the detail in Chapter 4 page 25 line 23 - 26 in order to present a clear, cohesive and consistent message throughout the report. [Kushla Munro, Australia]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
11605	23	15	23	16	It is not immediately obvious how the medium confidence that 1.5°C will be reached around 2030 fits with the high confidence for the 2021-2040 period in C.1.2 (lines 32-35). [Gerhard Krinner, France]	Taken into account. Text completely rewritten.
117225	23	15	23	16	include "of" before 1.5C and delete one of the ". " [Maisa Rojas, Chile]	Accepted
81901	23	15	23	16	Is global warming expected to reach 1.5C in 2030, or is there expected to be a year in which GMST is 1.5C above 1850-1900 levels around 2030? Not clear which one. If former, this is a dramatic change from SR15. [Dan Zwartz, New Zealand]	Taken into account. Text completely rewritten. Comparison to SR1.5 included.
9503	23	15	23	19	These critically important sentences need work as they are highly relevant to the Paris Agreement. Suggest rephrasing to read: Global warming 1.5°C is estimated to occur around 2030, across all scenarios assessed in this report (medium confidence). I also think that the SSP2-4.5 range needs to be included as a 'middle of the road' scenario. Scenario SSP1-1.9 is extremely unlikely given the current status of Nationally Determined Contributions (NDCs) to the Paris Agreement and the very high ECS of CMIP6 model simulations so probably shouldn't even appear in this summary statement. It would be very instructive to plot current emissions trajectory based on NDCs in Box SPM.2 Figure 1. It might help provide perspective and motivation for reducing emissions. Current NDCs put us somewhere in the SSP2-4.5 or SSP3-7.0 range so this should be stated. Remember this is a summary for policy makers, it needs to be very clear how far away we are from achieving the Paris Agreement targets. I think it should be stated that 1.5C is now unavoidable as an update to SR1.5 that concluded that it was 'geophysically feasible' to achieve 1.5C. We need to be very honest about the science in AR6 and show how current emission reduction pledges are still grossly inadequate and the realistic warming level that will be reached if emissions aren't drastically reduced. For example, is a warming of 2.5-3.5 by 2100 most likely based on current NDCs? A clear statement needs to be made in the AR6 SPM. The statement in lines 19-20, while true, is very weak and not very helpful for policy makers. It also does a disservice to the excellent science compiled in our report. [Joelle Gergis, Australia]	Taken into account. Text completely rewritten. That said, assessment of the effect of NDCs is outside the WGI remit.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90771	23	15	23	19	These two sentences are not clear: how is it possible to have anomalies below 1.5°C in 2081-2100 (anomalies of 1.2°C-1.8°C for SSP1-1.9) if global warming of 1.5°C is already estimated to occur across all scenarios assessed in this report around 2030? [José Romero, Switzerland]	Taken into account. Text now makes it clear that temperature overshoot occurs under in SSP1-1.9.
36165	23	15			?warming OF 1.5C [Michael PRATHER, United States of America]	Accepted
17493	23	15			To be consistent with core concepts the phraseology here: 'natural internal variability' should be amended. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
87137	23	15			The SR1.5 found that 1.5 would be reached around 2040 however this report is now saying 2030. Is this a result of the tempearture metric change ? Or are there other reasons which are not included? This change in the treatment of temperature is one of the most problematic dimension for the climate policy report and needs to be addressed with great care. [Jacqueline Spence, Jamaica]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
99983	23	15			The AR6 WGI change in temperature metric leads to all kinds of extreme conclusions. The SR1.5 found that 1.5°C would be reached around 2040. Now it's 2030. Grateful for a better explanation on this drastic change, Is this due to the temperature metric alone? Or are there other reasons for this change from SR1.5? This is the single most important dimension for climate policy of this report and needs to be assessed with great care. [Caroline Eugene, Saint Lucia]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
81845	23	15			Global warming of 1.5°C [Dan Zwartz, New Zealand]	Accepted
68805	23	15			The AR6 WGI change in temperature metric leads to all kinds of extreme conclusions. The SR1.5 found that 1.5°C would be reached around 2040. This report is estimating that it would be reached in 2030. Can you please clarify what metric was used to determine this? This is the single most important dimension for climate policy of this report and needs to be assessed with great care [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
53489	23	15			of 1.5°C relative to 1850-1900 (for those who will have missed Box SPM.1, probably a non-negligible fraction of the readers)? [Hervé Douville, France]	Taken into account. Text completely rewritten.
130065	23	16	23	16	Remove the extra ' ' [Trigg Talley, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
80405	23	16	23	16	An extra period should be deleted [Paola Arias, Colombia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
15381	23	16	23	16	".." -> "." [Masaki Satoh, Japan]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
23319	23	16	23	16	There is a mistake ("..") in the sentence. [Zhenzhong Zeng, China]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
65071	23	16	23	16	Double dots. [Magnus Joelsson, Sweden]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
81509	23	16	23	16	There is an additional 'full stop'. [Ee Ling Lee, Malaysia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90773	23	16	23	16	Delete one dot. [José Romero, Switzerland]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
84129	23	16	23	16	after "assessed in this report (medium confidence). " there are two . (points) [Manfred Treber, Germany]	Taken into account. Text completely rewritten.
87461	23	16	23	16	Extra full stop. [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
78283	23	16	23	16	Remove extra period after "(medium confidence)" [Leonie Lee, Singapore]	Taken into account. Text completely rewritten.
69379	23	16	23	19	Only two scenarios of SSP1-1.9 and SSP3-7.0 are selected here. It seems difficult to understand why the SSP3-7.0 is selected here. It will be better to show the SSP1-1.9 (corresponding to 1.5 °C) and SSP1-2.6 (corresponding to 2.0 °C), or full sets of five scenarios. [Kaoru Magosaki, Japan]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
81423	23	16	23	19	This doesn't stand well on its own. I think the nomenclature needs to be made clearer with plain language descriptions such as "SSP1 – very low emission scenario" to "SSP3 – Moderately high emission scenario" – or similar. I also question why given that there are 4 scenarios the highest is not used here to give the full range of outcomes. At the very least an explanation for the choice is required or it looks like an attempt to bias the message. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
97307	23	16	23	19	How do these values compare to the AR5? The warming levels at the end of the century are strongly dependent on prescribed radiative forcing, i.e. GHG emissions that are prescribed by the scenarios and the uncertainty is dominated by the reactions of the climate system (ECS) on these forcings as simulated by the ESMs and the TCR as stated in C1.3 Is the change caused by changes in the scenarios or by increased scientific understanding reflected in the ESMs? In addition, we suggest identifying an "AR5-temperature" that is equivalent to the temperature scale used in the AR5 and that is relevant for the Paris Agreement. [Nicole Wilke, Germany]	Taken into account. Some connection to AR5 is now made, but it would be confusing to the readers to present two parallel assessments.
11603	23	16	23	19	Confusing: likely or very likely? [Gerhard Krinner, France]	Taken into account. Text completely rewritten.
15447	23	16	23	19	For completeness, the anomalies for other SSP scenarios should also be included. [SAI MING LEE, China]	Taken into account. Text completely rewritten.
23393	23	16	23	19	I find it complex when two levels of calibrated language is used in the same sentence in this way. Is it possible to re formulate only keeping one level of likelihood? [Anna Amelia Sörensson, Argentina]	Accepted. Duplication removed.
41313	23	16	23	19	Please be more clear why you choose to highlight SSP3-7.0., e.g. with bracket "(unmitigated baseline scenario)". If you don't provide this kind of information in the headline statement, it has to be added at least in the following subsection, preferably with more detail. currently, there is no such information available and the box also falls short on providing more specific information what "unmitigated baseline" scenario actually means. [Alexander Nauels, Germany]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
105591	23	16	23	19	This sentence about 2081-2100 seems to be confused about likely and very likely ranges. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
9631	23	16	23	19	likely or very likely ? [Olivier Boucher, France]	Taken into account. Text completely rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130063	23	16	23	20	Improve the logical flow by moving up the last sentence of the paragraph "The magnitude of global warming..." to the end of the prior edited sentence that ends "(medium confidence)". Then edit the remaining sentence so as to consistently use "global warming" rather than introduce another proxy phrase for that quantity. Revise as follows: "Global warming over the period 2081-2100 is very likely to correspond to anomalies of 1.2 to 1.8°C for SSP1-1.9, and 2.9 to 4.7°C for SSP3-7.0." [Trigg Talley, United States of America]	Taken into account. Text completely rewritten.
44071	23	16			How can this headline statement that 1.5 degC will be reached already at 2030 be reconciled with the key finding SR1.5 that 1.5°C would be passed around 2040? A great deal of further explanation has to be done to not introduce inconsistencies between IPCC reports regarding an estimate of such high policy relevance. Please revise and expand! [Lamin Mai Touray, Gambia]	Taken into account. Comparison to SR1.5 on reaching 1.5°C of global warming has been added.
27907	23	17	23	17	Please use the nomenclature of Box SPM.1. Here, we don't know if we use GMST or GSAT. [Eric Brun, France]	Taken into account. SPM now only uses "global surface temperature".
65591	23	17	23	17	Suggest clarifying the global mean surface air temperature: is this referring to what we will observe or the anthropogenic warming only? [Kushla Munro, Australia]	Taken into account. SPM now only uses "global surface temperature".
82537	23	17	23	17	Refers to "global mean surface air temperature" - need to be clear whether this is GMST or GSAT (presumably the latter) [Blair Trewin, Australia]	Taken into account. SPM now only uses "global surface temperature".
6373	23	17	23	17	Having the words "likely" and "very likely" in this line do not make for easy reading. Can we not be told that the range of ... is likely to correspond to anomalies of ...? [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
86119	23	17	23	18	"temperature over the period 2081–2100 is very likely to correspond to anomalies of 1.2°C-1.8°C" – can this be simply reworded as "is projected to reach 1.2°C-1.8°C by 2081–2100"? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text completely rewritten.
8151	23	17	23	18	is it likely or very likely? [Frank Dentener, Italy]	Taken into account. Text completely rewritten.
44781	23	17	23	18	Why have the SSP1-1.9 and SSP3-7.0 been singled out here from all the scenarios? Information consistently in the SPM on the whole set of scenarios might be useful. [Markku Rummukainen, Sweden]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
104175	23	17	23	18	is it likely or very likely? [Philippe Tulkens, Belgium]	Taken into account. Text completely rewritten.
54663	23	17	23	19	Since the headlines statements will be read on their own by many people, it would be helpful to add some descriptive words here to the two scenarios mentioned. For example, add "lowest mitigation scenario" before SSP1-1.9 and add "unmitigated scenario" before SSP3-7.0. [Nancy Hamzawi, Canada]	Taken into account. Headline statement simplified radically.
104177	23	17	23	19	C1 . Selecting end of century temperatures only for SSP1-1.9 and SSP3-7.0 can be misinterpreted as suggesting that these are the only two outcomes. Re-phrase to make clear that this is a range, and if applicable explain why 7.0 rather than 8.5 is the chosen upper bound for the statement. [Philippe Tulkens, Belgium]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
17495	23	17			Is GMSAT correct here? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. SPM now only uses "global surface temperature".
34537	23	18	23	18	It's not clear if pre-industrial climate refers to 1750 or 1850-1900. [Russell Vose, United States of America]	Taken into account. Only 1850--1900 is used now.
44779	23	18	23	18	Suggest "changes" rather than "anomalies", as anomalies is a bit technical and this is about changes. [Markku Rummukainen, Sweden]	Taken into account. "Anomalies" no longer used.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27909	23	18	23	19	We suggest to mention in this headline the assessed GMST for the 5 considered SSPs as done in the 2nd sentence of C1.3. It would require very little space and it would emphasize that there is no reason in the SPM of WG1 report to give more priority or a higher occurrence probability to some of the SSPs. [Eric Brun, France]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
97309	23	18	23	19	Please replace "and of 2.9°C-4.7°C for SSP3-7.0" by "and of 3.5°C-5.6°C for SSP5-8.5" to reflect the full range of assessed scenarios. [Nicole Wilke, Germany]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
97311	23	18	23	19	Why did you choose these two scenarios and not the three other ones? There seems to be no reason, please give them all in the headline statement. In particular, SSP1-2.6 and SSP5-8.5, which are known from previous reports. Furthermore, the numbers given differ from Box SPM.2, Table 1, where a difference reference period is used. This might confuse the reader. Please revise [Nicole Wilke, Germany]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
112163	23	18	23	19	So why is the SSP5-8.5 forcing not given here at the upper end of the range? Is it considered somehow implausible, and if so then this decision would have to be substantiated here. It might also be useful to compare here the GSAT change responses for the equivalent forcing range as those assessed in AR5 (i.e. between RCP2.6 and RCP8.5), even if the forcings are not exactly equivalent. [Timothy Carter, Finland]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
86579	23	18	23	19	What is the rationale for only highlighting warming for SSP1-1.9 and SSP3-7.0 here ? Why not SSP1-1.9 and SSP5-8.5 to give the full range? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
42237	23	18	23	19	C1 Headline statement L18-19: Suggest replacing SSP3-7.0 with SSP5-8.5 to show the full range between upper and lower end scenarios. [Tina Christensen, Denmark]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
36167	23	18			what is "anomalies of" doing here, [Michael PRATHER, United States of America]	Taken into account. "Anomalies" no longer used.
27911	23	19	23	19	It would seem more logical to provide the warming levels for the all the scenarios. [Eric Brun, France]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
87335	23	19	23	19	add at the end: "predominately" (as part of the warming is due to historic emissions) [Marcel Berk, Netherlands]	Taken into account. Text completely rewritten.
88897	23	19	23	19	I think you need to specify 'global warming relative to present' since the statement is about future emissions. Warming we have had up until now are caused by past emissions. [Thorsten Mauritsen, Sweden]	Taken into account. Text completely rewritten.
23285	23	19	23	19	This sentence is misleading that all our climate future is determined by greenhouse gas emissions, yet other biophysical impacts of the earth's system can also be important. [Zhenzhong Zeng, China]	Taken into account. Text completely rewritten.
65585	23	19	23	20	Suggest changing the text for consistency with Section C.1.1. Currently the text reads "The magnitude of global warming ...will be determined by future greenhouse gas emissions...." This may be read as "will be determined ONLY by future greenhouse gas emissions". The subsequent section states the rate and magnitude of future warming will be determined by ... emissions, AND other factors. [Kushla Munro, Australia]	Taken into account. Text completely rewritten.
65593	23	19	23	20	Suggest rephrasing for accuracy: 'The magnitude of global warming by the end of the 21st century will be determined by future greenhouse gas emissions as well as - though less so - on emissions since reference period.' [Kushla Munro, Australia]	Taken into account. Text completely rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
93759	23	19	23	20	Is it possible to make clearer in this sentence that the magnitude of global warming will be dominantly determined by future greenhouse gas emissions? [Quentin Lejeune, Germany]	Taken into account. Text completely rewritten.
42363	23	19	23	20	Why only including SSP1 and SSP3 when comparing? Sentece in L 19-20 are the one-liner for this box but when put in the end it seems kind of like a repetition. Cold be moved to L5-6 as a kind of headline. [Tina Christensen, Denmark]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
40829	23	19	23	20	SPM <-> TS: Past emissions will not impact the magnitude of global warming? This seems to be taken into account in the TS (2.3.1) "After 2040, similar spatial patterns of present warming will continue to warm at a rate dependent on present and future emissions (high confidence)." , which is not cited in the SPM. [TSU WGI, France]	Taken into account. Text completely rewritten.
108269	23	19	23	20	This statement is only true if one excludes solar radiation management, and if on considers CDR an “emission”. I suggest to add “greenhouse gas emissions and other human interventions” [Johannes Quaas, Germany]	Taken into account. Text completely rewritten.
97313	23	19			It is not appropriate to choose SSP1-1.9 and SSP3-7.0 for the warming estimates in the headline while providing information for SSP5-8.5 elsewhere, e.g. for SLR in the SROCC. Please provide either the two extremes, i.e. SSP1-1.9 SSP5-8.5, or all assessed scenarios. [Nicole Wilke, Germany]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
36169	23	19			This is very strange, why pick out 2 of the SSPs, and particularly not the high one? Do all 5 (too messy here?), or the high and low. [Michael PRATHER, United States of America]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
17497	23	19			It is not clear why this second scenario SSP3-7.0 has been selected for this 'highlighted conclusions' box. Surely SSP1-2.6 or SSP5.85 would be more logical, for different reasons (2C or highest level of warming). [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten. Scenarios now covered more evenly.
27913	23	20	23	20	This conclusion is not new, so maybe add that the new results confirm that the magnitude of global warming. [Eric Brun, France]	Taken into account. Text completely rewritten.
27915	23	20	23	20	Please add "and removals" after "future greenhouse gas emissions". [Eric Brun, France]	Taken into account. Text completely rewritten.
86121	23	20	23	20	“future greenhouse gas emissions” – please specify: from 2020 onward, with emphasis on immediate future? The importance of what happens in the immediate future must come across clearly, due to cumulative effects of CO2. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text completely rewritten.
81425	23	20			Add the sentence at SPM-24 lines 30-31 here as this is a very important result which allows comparison with all previous IPCC reports [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text completely rewritten.
32371	23	20			Maybe "cumulative future GHG emissions"? [Clemens Schwingshackl, Norway]	Taken into account. Text completely rewritten.
65587	23	23	23	23	Suggest changing the text to "the rate and magnitude of future global warming will be determined by ..." for clarification. [Kushla Munro, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86123	23	23	23	23	“future” – this word is problematic. “Going forward” is more immediate. This idea of what we do for the rest of this year, and next year, and the year after, this needs to come across strongly. The immediacy of “future”. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17587	23	23	23	24	Using the term "natural forcing" to represent natural variability is not correct and misleading. It neglects the fact that natural variability has 2 components internal and external. Both components can influence climate on multi-decadal to millennium scale. It demonstrates the limitations of the global climate energy balance model with external forcing. Thus neglecting natural climate variability due to redistribution of energy through mainly complex non-linear ocean and atmospheric (turbulent) circulations, not fully understood today but real. [ferdinand meeus, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54665	23	23	23	25	It seems a gap not to mention internal climate variability here among all the factors that can influence the rate and magnitude of global warming. That said, we understand the purpose of this paragraph it to present conclusions on feedbacks, so would suggest the first sentence be rewritten to make that purpose more explicit. For example, something along the lines of "Climate system feedbacks can amplify or dampen the response to both anthropogenic and natural forcings." [Nancy Hamzawi, Canada]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
78623	23	23	23	29	C1.1 sounds waffly. The second sentence has "high confidence" but I've no idea what it means – I'm not even sure it actually is a sentence. The final sentence can stand. Suggest the rest isn't needed. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Bullet point removed from revised SPM.
77025	23	23	23	29	It is clearer if the text on human influences is separated for those that drive natural variability, e.g. separate sentences. [Emer Griffin, Ireland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77027	23	23	23	29	Text on human emissions pathways can be expanded here to explain the additional storage or capture of energy in the earth's climate system [Emer Griffin, Ireland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77029	23	23	23	29	net radiative feedback is quite obscure for policy. Can this be communicated in a more accessible manner? [Emer Griffin, Ireland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
9505	23	23	23	30	Chapter 8 on water cycle changes also deals with this content. Suggest cross reference to theory provided in section 8.2 [Joelle Joelle Gergis, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50261	23	23	23	30	It is likely to be unclear to a policymaker what is meant by 'non-Co2 biogeochemical changes'. Please could you explain or define. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
93621	23	23	23	30	This subsection should be close to subsections C.1.6 and C.1.7. All three could be at the beginning or end of section C.1.Lines 28 and 29 should in any case not remain here disconnected from subsections C.1.6 and C.1.7. [Jean-Louis Dufresne, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
107489	23	23	23	30	Discussion fails to highlight the essentially permanent nature of warming to CO2 forcing. There is a critical gap in public understanding of this system response which determines future warming levels. The long-term persistence of CO2 emissions is unlike other emissions more familiar to the public such as the precursors to smog. As such the "lock-in effect" drive by CO2 emissions is poorly understood by policy makers. SPM is the appropriate place to highlight the lock-in effect. [Hunter Cutting, United States of America]	Taken into account. The dominating effect of CO2 is explained in the intent of figure SPM.4 and shown in Figure SPM.4 b. However, the lock-in effect is not explicitly mentioned to keep the SPM short.
101567	23	23			Change "The rate and magnitude of future global warming is determined" to "The rate and magnitude of future global warming are determined" [Knute Nadelhoffer, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
53491	23	23			past and future human emissions pathways? [Hervé Douville, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
27917	23	25	23	25	Please add "is" between "The climate response" and "amplified by". [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
7695	23	25	23	25	It is suggested to insert "is" before "amplified by the" [Klaus Radunsky, Austria]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
89657	23	25	23	25	Not all feedbacks listed below will amplify the climate response, some will dampen it [Trude Storelvmo, Norway]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
19539	23	25	23	25	"is" missing before "amplified"? [philippe waldteufel, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
31579	23	25	23	25	Would that be clearer this way? « The magnitude of global warming is mitigated by ocean heat uptake, and amplified by ... » or maybe clarify the term « the climate response » [Jean-Baptiste SALLEE, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86125	23	25	23	25	Insert IS “amplified”? [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111473	23	25	23	25	"The climate response is amplified..." [James Renwick, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
12667	23	25	23	25	feedback is not always "amplified" effect [Lijing Cheng, China]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
44783	23	25	23	25	"storage of energy by the climate system" is a bit awkward expression. Would it be possible to be more clear, and refer to ocean heat uptake (and cryosphere melting?), if this is what is meant? [Markku Rummukainen , Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104179	23	25	23	25	Consider replacing "storage of energy by the climate system" with "storage of energy by the Earth system". [Philippe Tulkens, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
109311	23	25	23	25	"The climate response amplified..." Phrase is missing an "is," I think. [Paul Edwards, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25883	23	25	23	28	This sentence seems to be incomplete so the beginning of it "The climate response amplified" should be replaced by "The climate response was/is amplified" [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86969	23	25	23	28	Incomplete sentence [Oyvind Christophersen, Norway]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
6375	23	25	23	28	The sentence that spans these lines is incomplete. Is "will be" missing before "amplified", or is something else missing? [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
34539	23	25	23	28	I think this sentence is missing a verb somewhere. [Russell Vose, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130067	23	25	23	29	Missing verb. It should read "The climate response *is* amplified..." [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54667	23	25	23	29	The most important message for policy-makers in these lines is that the net feedbacks are all amplifying (positive) feedbacks. This message gets a bit lost in all the details. Recommend preceding line 25 with a new sentence to convey this overarching conclusion and then present the details about different feedbacks in subsequent sentences. [Nancy Hamzawi, Canada]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
15041	23	25	23	29	The grammatical problem notwithstanding, this statement is quite crucial to the whole global warming issue but is presented in the SPM in a rather subdued yet (over?) confident way. Even after reading the full report and the literature references therein I am not convinced it is true. I'd consider this a relatively rare situation where more detail is required. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36171	23	25			The sentence beginning this line is not a sentence. [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
101569	23	25			Change "The climate response amplified" to "The climate response is amplified" [Knute Nadelhoffer, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
117229	23	26	23	27	delete reference to SPM Box 1 [Maisa Rojas, Chile]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86581	23	27	23	27	Shouldn't it be : CO2 and non-CO2 feedbacks? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111649	23	28	23	29	This sounds like a major advance. Suggest comment on what it implies for ECS/TCR. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86127	23	28	23	29	Please reword this sentence to clarify. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
42411	23	28	23	30	The halving of uncertainty range on net cloud feedback would appear to be a major step since AR5. [Tina Christensen, Denmark]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77031	23	28	23	30	Welcome the halving the uncertainty range. However, what is the message for policy? [Emer Griffin, Ireland]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
19541	23	28	23	46	Why is this paragraph in italics? [philippe waldteufel, France]	Accepted. In the revised SPM, the only parts italicised are the uncertainty language and the introduction of each section.
8153	23	29	23	29	Possibly provide numbers climate feedback and for all uncertainties (or aggregated for non cloud-feed backs), so that a basis high confidence is given. [Frank Dentener, Italy]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
97317	23	32	23	32	Please explain the change of the timing of reaching 1.5 °C when compared to the SR1.5 in terms of the "AR5-temperature". Please avoid confusion with the statement provided in the headline statement of C1. [Nicole Wilke, Germany]	Rejected. It would be extremely confusing to readers if presented with two different assessments here in the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65595	23	32	23	32	Please clarify: 'A global surface air temperature warming level of 1.5°C relative to '. Suggest clarifying statements that relate to anthropogenic warming, not global average temperatures that will be observed, unless otherwise stated, and explaining why the distinction is needed. [Kushla Munro, Australia]	Taken into account. Uncertainty from internal variability is now included (covered in chapter text).
65597	23	32	23	32	Suggest consistency. For example, the following convention was used in AR5/Ch 11 and AR5/SYR: when "near term" is used as a noun as in "the near term" it doesn't have a hyphen. If it is used in conjunction with a noun like "near-term projection", then it does have a hyphen. [Kushla Munro, Australia]	Accepted and implemented.
69381	23	32	23	33	We would like to suggest stating clearly that the best estimate for the year reaching global warming level of 1.5°C relative to 1850-1900 is about ten years earlier than the best estimate given in the SR1.5 as stated in the underlying chapter (Chapter9, page35. lines 28-31). Since this is an extremely important assessment that is very relevant for policy makers, it would be requested that the factors that influenced the changes in the estimates are also clearly stated in the SPM. [Kaoru Magosaki, Japan]	Taken into account. Comparison to SR1.5 now added, including a detailed explanation for why no direct comparability exists.
130069	23	32	23	33	Revise beginning of first sentence as follows: "Global warming in the near-term (2021-2040) relative to 1850-1900 of 1.5C is very likely to be...." [Trigg Talley, United States of America]	Taken into account. Sentence reformulated.
77033	23	32	23	34	"Global warming of 1.5C is very likely to occur between 2021 and 2041 for all but the lowest emissions scenarios considered in the AR6. This warming is the projected increase in the surface air temperature relative to the average temperature in the period 1850 to 1990". Even for the lowest scenario this level of warming is likely and not to occur during this period. [Emer Griffin, Ireland]	Taken into account. Sentence reformulated.
27919	23	32	23	35	We're not sure how to read this. Is it only "very likely" that 1.5°C relative to 1850-1900 can be reached with SSP585? Is it not absolutey certain? "likely" is also a weak statement for SSP245. [Eric Brun, France]	Noted. Statement refers to the near term.
97315	23	32	23	35	Please add a similar paragraph for 2C warming. [Nicole Wilke, Germany]	Accepted. The 1.5°C and 2°C warming levels are now treated more evenly.
111651	23	32	23	35	This is a useful paragraph. I think it's important to say when the warming threshold is only passed temporarily (e.g. for SSP1-1.9, see Fig SPM.7?). [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Sentence added.
111653	23	32	23	35	This is a useful paragraph. A warming threshold of 2C is also part of the Paris agreement and I suggest a corresponding paragraph for 2C warming would be valuable. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The 1.5°C and 2°C warming levels are now treated more evenly.
97319	23	32	23	35	Please give such information also for 2°C in terms of the "AR5-temperature", the main mitigation objective of the Paris Agreement. [Nicole Wilke, Germany]	Rejected. It would be extremely confusing to readers if presented with two different assessments here in the SPM.
97321	23	32	23	35	That global warming of more than 1.5 C is reached in all scenarios (even in SSP1-1.9!!!) and that it is more likely than not to be reached, means that the entire AR6 will look at overshoot scenarios (or even higher temperatures). Hence, one of the temperature goals of the Paris Agreement is out of reach. Please note our suggestion of an "AR5-temperature". We strongly request the authors to provide more information on this fact as it is highly policy relevant. [Nicole Wilke, Germany]	First part noted, second part rejected. It would be extremely confusing to readers if presented with two different assessments here in the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
31809	23	32	23	35	If I understood correctly I would suggest change the sentence to It's very likely that by the near-term (2021-2041) global surface air temperature warming level in scenarios SSP3-7.0 and SSP5-8.5 will reach 1.5°C relative to 1850–1900 period. And likely to be reached in scenarios SSP1-2.6 and SSP2-4.5, and more likely than not to be reached in Scenario SSP1-1.9 (high confidence).{2.3.1, 4.3.1, 4.4.1, Box 4.1, Cross-Chapter Box 2.3, TS Table TS.2} [Izidine Pinto, South Africa]	Taken into account. Sentence reformulated.
23395	23	32	23	35	Why is likelihood and confidence level used for the same statement? [Anna Amelia Sörensson, Argentina]	Taken into account. Duplication removed.
131739	23	32	23	35	This sentence is difficult to read, and without referring back to Box SPM2, Table 1 does not convey that 1.5C will be reached later than 2040 in some cases. As the details are in Box SPM, Table 1 - could the likelihood levels be added there and the bullet simplified? [Hans Poertner and WGII TSU, Germany]	Taken into account. Sentence reformulated.
9633	23	32	23	35	I am not sure how to read this. Is it only "very likely" that 1.5°C relative to 1850-1900 can be reached with SSP585 ? Is it not absolutely certain ? "likely" is also a weak statement for SSP245. [Olivier Boucher, France]	Noted. Statement refers to the near term.
117227	23	32	23	35	Is this calculated from table 1 of SPM Box2? IN that table all the scenarios look like reaching 1.5C. Why the different likelihood? [Maisa Rojas, Chile]	Taken into account. Text and table have been simplified radically.
114937	23	32	23	35	This message mixes likelihood and confidence statements together which is explicitly advised against in the uncertainty guidance note. You can either use likelihood if you know the (subjective) probabilities or you use confidence if you do not know these probabilities. How would probability statements be derived for the timing of reaching 1.5°C? This information relies (in parts) on the non-random CMIP6 sample which has no assigned probabilities unless the authors determined a subjective prior for the sample. [Elmar Kriegler, Germany]	Taken into account. Duplication removed. The statements rely on assessed global surface temperature change; method is described in detail in Chapter 4, but here it has been added that multiple lines of evidence have entered, over and above CMIP6.
31803	23	32	23	46	Paragraph C.1.2 and C.1.3 is confusing due to the use of two different baselines to compare the changes. I find it difficult to get a message here. [Izidine Pinto, South Africa]	Accepted. Text now shows changes relative to 1850--1900 only.
42239	23	32	23	46	C1.2 and C1.3 repeats information from the tables in Box SPM2. Could the text be replaced with a reference to the tables? [Tina Christensen, Denmark]	Taken into account. Text and table have been simplified radically.
93623	23	32	23	47	The writing of sections C.1.2 and C.1.3 is completely different, and it is different to understand why. In C.1.3, why the warming compared to the 1995-2014 period is mentioned in the first sentence in addition to the 1850-1900 period in the second sentence? Lines 42-46: which century? This later sentence is not comprehensible. [Jean-Louis Dufresne, France]	Accepted. Text now shows changes relative to 1850--1900 only.
131741	23	33	23	33	near term is 2021-2040 [Hans Poertner and WGII TSU, Germany]	Accepted and fixed.
130071	23	34	23	35	The double use of confidence language is odd. There are already likelihood quantifiers in the sentence, "very likely", "likely", etc. Why is there also "(high confidence)" at the end? Is this meant to indicate a level of confidence in the assignment of likelihood? It seems unnecessary. [Trigg Talley, United States of America]	Taken into account. Duplication removed.
31807	23	38	23	38	I would suggest change 'Global warming in 2081-2100...' to 'Global surface air temperature in 2081-2100...' [Izidine Pinto, South Africa]	Taken into account. Text and table have been simplified radically.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86129	23	38	23	38	The multiple baselines used in the SPM are going to be very confusing for some policy makers. For example in this sentence why is the 1995-2014 baseline being used and not 1850-1900? The importance of each baseline and their use need to be clearly explained. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text now shows changes relative to 1850--1900 only.
27921	23	38	23	40	We suggest to delete the 1st sentence which has no added-value compared to the 1st part of the 2nd sentence. As for Box SPM.2 Table 1, we have a strong preference for choosing 1850-1900 as the reference period. This would be more consistent with the Paris Agreement temperature goal and easier to compare for policy-makers. Deleting the 1st sentence and keeping only the 1st part of the 2nd sentence - to be adapted - would shorten the SPM which is too long. [Eric Brun, France]	Accepted. Text now shows changes relative to 1850--1900 only.
131743	23	38	23	40	It would be easier to read and understand this message, if the scenarios would be put in brackets right behind the individual temperature ranges. For instance: "...is very likely 0.3-0.9°C (SSP1-1.9).....otherwise you force the reader to read this sentence at least 5 times to relate the temperature facts to the respective scenarion. That's not userfriendly. [Hans Poertner and WGII TSU, Germany]	Taken into account. Text and table have been simplified radically.
131745	23	38	23	40	The details are given in Box SPM2, Table 1 - could this bullet be simplified eg remove first sentence [Hans Poertner and WGII TSU, Germany]	Taken into account. Text and table have been simplified radically.
69383	23	38	23	41	It would be better to include the best estimates of projected GSAT for each scenario as shown in Box SPM.2, Table 1. [Kaoru Magosaki, Japan]	Taken into account. Text and table have been simplified radically.
97323	23	38	23	42	For better readability please write 0.3-0.9°C (SSP1-1.9), 0.6–1.4°C (SSP1-2.6), ... [Nicole Wilke, Germany]	Taken into account. Text and table have been simplified radically.
50269	23	38	23	42	As per earlier comments, I would sugget to flip these two sentences around, and start with temperature projections relative to the pre-industrial, as this is more policy relevant, compared to the recent baseline (1995-2014). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text now shows changes relative to 1850--1900 only.
87233	23	38	23	42	Please consider to shorten and integrate these two sentences. It could be easier for the reader if you started by establishing the 0.9C difference, and preferably only provided numbers for one of the endpoint periods. Please also check for consitency of the numbers with what is provided both in Box.TS.1 Table 1 (TS page 24) and Cross-section Box 1 (TS page 63-64) . [Oyvind Christophersen, Norway]	Taken into account. Text and table have been simplified radically.
44785	23	38	23	42	As this is SPM, one could give the ranges relative to preindustrial/1850-1900, which would also shorten the text. [Markku Rummukainen , Sweden]	Taken into account. Text now shows changes relative to 1850--1900 only.
132619	23	38	23	46	It is unclear whether this is the raw model range of projections (I think it might be) or if this is the projected warming range constrained by estimates of ECS, TCR and by the historical warming record. (described in Chap 4). I think both raw and constrained projections should be reported here, and their difference clarified. This constrained ranges based on observed warmign and the use of emulators informed by ECS and TCR is a major update from AR5 and needs more description. [Kyle Armour, United States of America]	Taken into account. The statements rely on assessed global surface temperature change; method is described in detail in Chapter 4, but here it has been added that multiple lines of evidence have entered, over and above CMIP6. It would be confusing and model documentation rather than assessment if CMIP6 results were reported in addition.
80407	23	38	23	46	All the paragraph uses italics [Paola Arias, Colombia]	Accepted and fixed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9507	23	38	23	46	This is very poorly phrased for such important conclusions. What is the main message for a policy maker here? Suggest only quoting results for the most likely scenarios based on current National Determined Contributions. There is no point stating warming for SSP1-1.9 when is impossible to achieve given current pledges. If the IPCC does not have a clear statement on those upper estimates commentators will step in with their non-expert opinion, which is unlikely to be helpful. Also leaves the IPCC open to criticism of 'hiding the truth' from the public (not a position I agree with at all, but I've been very surprised to read this many times in the public commentary). Suggest being very clear about the high impact end of the projections and how likely they are given current emission reduction pledges and the the high ECS of CMIP6 simulations. Essential to remember that this is a document for policy makers and its direct relevant to the Paris Agreement. Greenland ice sheet instabilities are seen with warming between 2-3C (see C2)so we need to be very clear about what higher levels of warming mean for impacts, climate change adaptation, irreversible changes, tipping points, low likelihood, high impact events etc. [Joelle Joelle Gergis, Australia]	Taken into account. Text and table have been simplified radically. It is out of the WGI mandate to assess the degree of realism of the different scenarios.
31805	23	38	23	46	I found difficult to understand to what “corresponds respectively to global warming levels of 1.2-1.8°C, 1.5-2.3°C, 2.2-3.4°C, 2.9-4.7°C and 3.5-5.6°C compared to pre-industrial climate, given the ca. 0.9°C global warming observed from 1850-1900 to 1995-2014”. The increase in global mean surface temperature in 2081-2100 compared to 1995-2014 is between 0.3-0.9°C and this corresponds to global warming levels of 1.2-1.8°C in the scenario SSP1-1.9 compared to pre-industrial climate? What is the message here when comparison of changes for two different baselines is made? Could this be assessed and clarified in the text? [Izidine Pinto, South Africa]	Taken into account. Text and table have been simplified radically.
78659	23	38	23	46	Too much of the text is in italic. [Heike Wex, Germany]	Accepted and fixed.
37717	23	38	23	46	The whole paragraph is in italics - if there is a reason for this it should be made clear. [Stephanie Arcusa, United States of America]	Accepted and fixed.
50271	23	38	23	46	Suggest this section also mentions remaining gas cycle uncertainty (currently the paragraph focuses on “concentration driven” runs and the uncertainty around them). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This uncertainty is small, as assessed in Chapter 4.
37799	23	38	23	46	The font is strange, please check. [Junhee Lee, Republic of Korea]	Accepted and fixed.
101571	23	38	23	46	Why is this paragraph italicized? I suggest using normal typeface, except for phrases such as 'very high confidence' so as to be consistent across this section. [Knut Nadelhoffer, United States of America]	Accepted and fixed.
34541	23	38	23	46	It's not clear why this text is in italics. [Russell Vose, United States of America]	Accepted and fixed.
34543	23	38	23	46	It seems to me that the last sentence in C.1.3 is really the key message here and thus should come first in the paragraph. The SSP numbers could follow thereafter (and hopefully in a somewhat condensed form, as in C2.5). [Russell Vose, United States of America]	Taken into account. Text and table have been simplified radically.
104181	23	38	23	46	Figures provided in C.1.3 are rather clear and easily understandable. Accompanying explanations should clarify if the corresponding scenarios include or not overshoot (see the associated discussion in SR15), and, if possible, should provide some figures for temperature over land and temperature over oceans (following B2.1, page 10, lines 8-10). [Philippe Tulkens, Belgium]	Taken into account. Text and table have been simplified radically.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50275	23	38	24	14	It would be useful for policymakers to specifically mention in C1.3 and C1.4 how the projected warming under different scenarios and how the updated TCRE range compares to AR5 estimates. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Tight space constraints enforced concision. This information is in the TS and chapters.
93761	23	38	38	42	Is it needed to mention these figures both here and in Box SPM2? The SPM can potentially be shortened here. [Quentin Lejeune, Germany]	Taken into account. Text and table have been simplified radically.
130073	23	38			Revise beginning of first sentence as follows: "Global warming in 2081-2100 relative to 1995-2014 is very likely to be ..." [Trigg Talley, United States of America]	Taken into account. Text now shows changes relative to 1850--1900 only.
31595	23	40	23	40	"to global warming level": I think it would be less confusing to say « to 2100 global warming of » rather than « global warming level » since "global warming level" are often used as a metric independent of time, so here employing this term could wrongly give the sense that SSP5-8.5 will equilibrate at 3.5-5.6, while it is only the transient temperature change in 2100. [Jean-Baptiste SALLEE, France]	Taken into account. Text and table have been simplified radically.
101573	23	40	23	41	Change "This corresponds respectively to global warming levels of 1.2-1.8°C, 1.5-2.3°C, 2.2-3.4°C, 2.9-4.7°C and 3.5-5.6°C compared" to "This corresponds, respectively, to global warming levels of 1.2-1.8°C, 1.5-2.3°C, 2.2-3.4°C, 2.9-4.7°C, and 3.5-5.6°C compared" [Knut Nadelhoffer, United States of America]	Taken into account. Text and table have been simplified radically.
130075	23	40	23	42	Revise the sentence as follows: "This warming is in addition to 0.9°C global warming observed from 1850-1900 to 1995-2014." [Trigg Talley, United States of America]	Taken into account. Text and table have been simplified radically.
14561	23	40	23	42	This sentence is very unclear, and anyway why is it here in section C which is all about the future? [Roshanka Ranasinghe, Netherlands]	Taken into account. Text and table have been simplified radically.
53493	23	40	23	42	May be too many numbers? Just say that you need to add about 0.9°C to estimate the GSAT increase relative to 1850-1900, but also to multiply by a factor ? to estimate the land-only global warming. [Hervé Douville, France]	Taken into account. Text and table have been simplified radically.
86131	23	42	23	43	"The magnitude in global warming by the end of the century is dominated by greenhouse gas emissions still to be emitted into the atmosphere" – is not clear. Is "determined by" perhaps better than "dominated by"? Then it would make sense. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Text and table have been simplified radically.
77035	23	42	23	44	"future emissions" rather than "emissions still to be emitted" [Emer Griffin, Ireland]	Taken into account. Text and table have been simplified radically.
77037	23	42	23	44	"future emissions" rather than "emissions still to be emitted", and reference years should be clear, i.e. from 2018? [Emer Griffin, Ireland]	Taken into account. Text and table have been simplified radically.
108271	23	42	23	44	"still to be emitted" too much refers to actual emissions. However, negative emissions (CDR) certainly will play a big role, as will possibly SRM. [Johannes Quaas, Germany]	Taken into account. Text and table have been simplified radically.
37719	23	42	23	45	The terms ECS and TCR need to be defined, possibly as footnotes? [Stephanie Arcusa, United States of America]	Taken into account. Text and table have been simplified radically.
44787	23	42	23	45	Does this refer to uncertainty ranges for each specific emission scenario, given that the level of warming is so different for the different scenarios? What would other contributors be? Are the uncertainty ranges the ranges quoted at the beginning of C1.3? [Markku Rummukainen, Sweden]	Taken into account. Text and table have been simplified radically.
42241	23	42	23	46	C1.3 L42-46: Move this description to C1.6 or C1.7 where the terms ECS and TCR are being used again, and elaborate on the definition of these technical terms [Tina Christensen, Denmark]	Taken into account. Text and table have been simplified radically.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
101575	23	42			Change "The magnitude in global warming" to "The magnitude of global warming" [Knute Nadelhoffer, United States of America]	Taken into account. Text and table have been simplified radically.
6377	23	43	23	43	"greenhouse gas emissions still to be emitted" is awkward wording. Would "future emissions of greenhouse gases" be better? [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text and table have been simplified radically.
41315	23	43	23	45	The second part of this sentence is not useful as these concepts are only introduced/explained in subsection C1.6. also, those concepts only capture the uncertainties from the actual responsible physical processes. Suggest to delete. [Alexander Nauels, Germany]	Taken into account. Text and table have been simplified radically.
130077	23	44	23	44	subject-verb agreement: Replace "is" with "are" [Trigg Talley, United States of America]	Taken into account. Text and table have been simplified radically.
50273	23	44	23	44	Suggested edit for clarification: 'The magnitude in global warming by the end of the century is dominated by the uncertainty in the likely temperature response of the planet to greenhouse gas emissions still to be emitted into the atmosphere...'? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text and table have been simplified radically.
84131	23	44	23	44	uncertainty ranges for that period is dominated -> are dominated [Manfred Treber, Germany]	Taken into account. Text and table have been simplified radically.
19543	23	44	23	45	Neither ECS nor TCR are quoted in the Glossary, nor defined in any of the references listed here. Very short information is given on P24 L25-26. A little care is recommended when introducing the reader to these important entities. [philippe waldteufel, France]	Taken into account. Text and table have been simplified radically.
17499	23	44	23	45	ECS and TCR need further explanation so that C.1.6 and subsequent paras are more meaningful. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text and table have been simplified radically.
131747	23	44	23	45	ECS / TRC: technical jargon that makes it really difficult for non-scientists to understand your message - and the SPM is supposed to be read by many stakeholders, many of them non-scientists [Hans Poertner and WGII TSU, Germany]	Taken into account. Text and table have been simplified radically.
104183	23	44	23	45	"uncertainty ranges for that period is dominated by the uncertainty in Equilibrium Climate Sensitivity (ECS) and Transient Climate Response (TCR)". Attributing uncertainty ranges to uncertainties in the ECS and TCR seems tautological. It suggests that ECS and TCR are inherent constants of the climate system for which absolute true values ought to exist, rather that artificial constructs represening a useful, but inherently uncertain simplification. [Philippe Tulkens, Belgium]	Taken into account. Text and table have been simplified radically.
97325	23	44	23	46	Why both on ECS and TCR? Can this be expressed in simpler way to be understandable for laypersons, possibly without mentioning TCRE and ECS which are only explained in later paragraphs? [Nicole Wilke, Germany]	Taken into account. Text and table have been simplified radically.
78625	23	44			TCR and ECS are important uncertainty sources, yes, but so are carbon cycle feedbacks – if you are relating warming to emissions then TCRE is the metric required and this combines both physical and carbon uncertainty. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text and table have been simplified radically.
36173	23	44			"uncertainty ranges" this needs to be qualified as for a specific scenario, since the scenario range will be read/seen by most as part of the uncertainty. [Michael PRATHER, United States of America]	Taken into account. Text and table have been simplified radically.
81847	23	44			Change "is" to "are": "uncertainty ranges for the period are dominated by" [Dan Zwartz, New Zealand]	Taken into account. Text and table have been simplified radically.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
101577	23	44			Change "uncertainty ranges for that period is dominated" to "uncertainty ranges for that period are dominated" [Knute Nadelhoffer, United States of America]	Taken into account. Text and table have been simplified radically.
65599	23	45	23	45	Consider simplifying this SPM statement and reconsider the inclusion of TCR and CS. You might refer for example to model differences in the warming that occurs in response to greenhouse gas forcing. [Kushla Munro, Australia]	Taken into account. Text and table have been simplified radically.
116105	23		23		I suggest to reconsider the preamble which contrasts scenarios and warming levels, while they are complementary (and warming levels are related to projected regional changes). Considerations of rates of changes are also important (eg for adaptation) so this preamble could introduce the various aspects of possible futures. [Valerie Masson-Delmotte, France]	Taken into account and re-written; warming levels no longer appear in the section introduction.
116107	23		23		HSC1 and C1.2 also need to consider insights from simulations accounting or not for future volcanic eruptions (in addition to scenarios focusing on consequences from human activities only). Missing information here on net zero emission commitment (just 1-2 sentences). [Valerie Masson-Delmotte, France]	Taken into account and re-written; volcanic eruptions now mentioned in the section introduction.
77679	23				section c.1.3 in italics [Emer Griffin, Ireland]	Accepted. In the revised SPM, the only parts italicised are the uncertainty language and the introduction of each section.
25885	24	2	24	2	We would like to clarify whether "global mean temperature" refers to GSAT. [Don Alfonso Pino Maeso, Spain]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
44789	24	2	24	5	Is the "approximately constant" significantly different for emission pathways that lead to over 2 deg. warming? The meaning is not entirely clear here. [Markku Rummukainen, Sweden]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1
78627	24	2	24	13	Long winded paragraph – consider dropping second half. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was edited down and included in HS.13.1
50501	24	2	24	13	This paragraph could cause some confusion amongst readers about the potential for future warming after net zero co2 is reached. It leaves open the possibility of further warming (which is correct) but implies less certainty about this issue. In chapter 5 (page 84) the review of the literature states "in most cases showing that once CO2 emissions decline to net zero levels, they do not contribute to substantial further warming". Additionally, the Jones et al ZECMIP paper (https://www.biogeosciences-discuss.net/bg-2019-492/) demonstrates that the mean of the model ensemble is just below 0. Their conclusion is "Overall, the most likely value of ZEC on decadal time-scales is assessed to be close to zero, consistent with prior work. However substantial continued warming for decades or centuries following cessation of emission is a feature of a minority of the assessed models and thus cannot be ruled out." - suggest this framing is used here. i.e. the evidence suggests that net zero will result in no further warming, however it cannot be totally certain that this is the case. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was edited down and included in HS.13.1

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90195	24	2	24	14	Paragraph C1.4 could be skipped from the SPM as it very technical and should rather be include in the TS. Only the main message that for AR6 climate projections, other lines of evidences, based on observations and climate research, have been used than purely climate model based results. [Georges Gehl, Luxembourg]	Taken into account - The paragraph was edited down and included in HS.13.1
131749	24	2	24	14	Very technical and dense bullet, could this be simplified? [Hans Poertner and WGII TSU, Germany]	Taken into account - The paragraph was edited down and included in HS.13.1
77039	24	2	24	14	This is very important but made obscure by the verbal construct used. Please focus on the substance i.e. the global temperature is projected to increase by between 1.0 and 2.2 C for each 1000 PgC emitted. Then expand with necessary detail only. [Emer Griffin, Ireland]	Taken into account - The paragraph was edited down and included in HS.13.1
77041	24	2	24	14	Can 1000 PgC be expressed as CO2 also? [Emer Griffin, Ireland]	Accepted
77043	24	2	24	14	See earlier points on referencing AR5, row 29. it's better to collect these at the start. [Emer Griffin, Ireland]	Taken into account. HS13.1, covering TCRE, starts by mentioning AR5.
77045	24	2	24	14	This section introduces Net-zero CO2 emissions, which is a big message for policy. The text explaining this should be clearer. [Emer Griffin, Ireland]	Taken into account - The paragraph was edited down and included in HS.13.1
114939	24	2	24	14	This message mixes likelihood and confidence statements together which is explicitly advised against in the uncertainty guidance note. You can either use likelihood if you know the (subjective) probabilities or you use confidence if you do not know these probabilities. But you cannot use quantification and qualification of uncertainty at the same time for the same statement. [Elmar Kriegler, Germany]	Accepted - This has been addressed in the revised HS.13.1
14563	24	2	24	42	Although all the text in C1.4 to C1.7 might be very interesting to and easily understandable to a climate scientist, these details are probably too technical for the average policy maker. Can these be replaced with statements that are more useful for the average policy maker? [Roshanka Ranasinghe, Netherlands]	Taken into account. In a general push to simplify the SPM, reduce its length and focus on what matters most for policy-makers, we have significantly reduced the coverage of scientific concepts such as ECS, TCR, TCRE and we now focus on the aspects of those concepts that are policy relevant.
97327	24	2	24	43	Since the TCRE is highly relevant for the C-budget which is addressed in section D1, it would be useful to move para C1.4 to C1.7 into section D1. In addition, the sequence of these subsections should be revisited and the information on the TCRE be addressed in one paragraph. The second part of C1.4 and C1.5 could be joint. Please indicate how much the TCRE changed in comparison to the SR1.5. I [Nicole Wilke, Germany]	Taken into account. TCRE is now addressed in one bullet, which now sits in the section called 'limiting climate change'.
42243	24	2			C1.4: Is global mean temperature here GSAT or GMST? [Tina Christensen, Denmark]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
130079	24	3	24	3	The Transient Climate Response to Cumulative Carbon Emissions (TCRE) is defined here. Later (P24 L25) the Transient Climate Response (TCR) is defined. Are these the same? If so, use consistent terminology. [Trigg Talley, United States of America]	They are not, and should be defined separately. Note however that TCR is no longer mentioned in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104185	24	3	24	3	If the TCRE is different from TCR mentioned elsewhere in the section, then please clarify the difference. If it is the same, then the same term should be used. [Philippe Tulkens, Belgium]	Taken into account - these two concepts are now presented in clearly distinct locations.
111475	24	3	24	4	Change to "...stays approximately constant over the 21st century until peak warming, for emission pathways..." [James Renwick, New Zealand]	Taken into account - The paragraph was edited down and included in HS.13.1
27923	24	5	24	5	To ensure a better understanding by policy-makers, we have a strong preference for using the unit °C per 1000 GT CO ₂ instead of °C per 1000 PgC plus a footnote. Indeed GT CO ₂ is a quite common unit for annual emissions and the link between cumulative emissions and annual emissions is easier if this unit also used for cumulative emissions. [Eric Brun, France]	Taken into account - also information for GtCO ₂ is now included
11607	24	5	24	5	cut "in the" [Gerhard Krinner, France]	Noted - editorial
11613	24	5	24	5	Let's not forget to provide the correct conversion in the final draft in this footnote... [Gerhard Krinner, France]	Noted
10199	24	5	24	5	Note TCRE is quoted in PgC, but CO ₂ emissions are quoted in Gt CO ₂ . [Robert Kopp, United States of America]	Taken into account - also information for GtCO ₂ is now included
69385	24	5	24	6	It would be better to add the best estimates of TCRE. [Kaoru Motosaki, Japan]	Rejected - for conciseness, this information was not included in this paragraph
3589	24	5	24	7	The most recent figure at this moment is those by SR1.5. SR1.5 provides two TCRE figures, one by CMIP5 and the another by observation, though those are shown by 1000GtCO ₂ (see p. 106 of Chapter 2 of SR1.5). Some comments why TCRE here differs from SR1.5 should also be discussed here for reader friendliness purpose. [Mitsutsune Yamaguchi, Japan]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.5
130081	24	5	24	7	Strike the two sequential sentences starting with "The TCRE is likely in the 1.0-2.2...This is a slightly more narrow range..." to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1
16055	24	7	24	7	"Additional Earth system feedbacks". It is not clear what "additional" means. In addition to what? Maybe say "feedbacks often not included in climate models" if that is what is meant. [Daniel Lunt, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - This has been addressed in the revised HS.13.3
80123	24	7	24	7	The different lines of evidence is not specific enough. Could the narrower range be due to that models better resolve processes? [Lilian Fejes, Hungary]	Taken into account - not really, in this case; the main reason is a narrower assessment of TCR, which feeds into the assessment of TCRE
38931	24	7	24	11	Could these two sentences be merged and "have the potential to weaken the linearity of the cumulative carbon-climate relationship" be omitted (readers from outside the climate science community might find it less easy to interpret than the following sentence)? Would the confidence statement be a different one in that case? I understand the explanation given in the following sentence, but would process knowledge not lead to a higher confidence level - separately from the question of how much models can be trusted? [Maike Nicolai, Germany]	accepted. those sentences do not appear anymore
36175	24	7			"Additional ..." It really should be mentioned that additional uncertainty comes from non-CO ₂ GHG. [Michael PRATHER, United States of America]	Accepted - This has been addressed in the revised HS.13.2
111655	24	8	24	8	Not sure 'weaken' is the right word here. 'Break'? Or 'disrupt'? [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
86583	24	8	24	8	"... and changes in the land sink" Unclear what you mean here and potentially misleading. Changes in the land sinks are accounted for in TCRE estimates and its linearity. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65601	24	8	24	8	For clarity, we suggest the text be changed to: "...have the potential to alter the cumulative carbon-climate relationship". The text currently states: "have the potential to weaken the linearity". However, this may be misread as meaning the feedbacks have the potential to weaken the cumulative carbon-climate relationship. [Kushla Munro, Australia]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
29417	24	8	24	8	low emission scenario [Joachim Fallmann, Germany]	Noted - editorial
44791	24	8	24	9	"have the potential... relationship. This"... could be omitted, leading to "... land carbon sink could result..." [Markku Rummukainen, Sweden]	Noted - this part was omitted
44793	24	8	24	11	Would it be reasonable to also highlight here the role of water table and drainage changes as a significant factors, see e.g. section 5.4.8.2? [Markku Rummukainen, Sweden]	Rejected - this was not assessed in context of TCRE
29415	24	9	24	9	higher and further warming [Joachim Fallmann, Germany]	Noted - editorial
101579	24	9			Delete "potential". [Knut Nadelhoffer, United States of America]	Accepted
50281	24	10	24	11	path dependency of warming as a function of cumulative emissions of CO ₂ is a bit confusingly worded for me. Is there a simpler way of putting this? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
27927	24	11	24	11	This is an unusual way to express informations in an IPCC report. The sentence should be reformulated : "Processes are well understood but..." [Eric Brun, France]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
27929	24	11	24	11	Please correct: "model results" is more correct than "models". [Eric Brun, France]	Noted - editorial
17717	24	11	24	11	Consider omitting "we" in the sentence. [Anette Jönsson, Sweden]	Noted - editorial
86585	24	11	24	11	"We understand the processes well". Which ones? Isn't the fact that models are inconclusive a proof that we don't understand these processes well? Otherwise how do you explain models being inconclusive ? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
41317	24	11	24	11	Suggest to rephrase beginning of sentence to "Most underlying processes are well understood, but models..." as the current statement does not hold given the unknowns in carbon cycle projections, for example. [Alexander Nauels, Germany]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
10201	24	11	24	11	If the processes were well understood, wouldn't they be well represented in models? [Robert Kopp, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
27925	24	11	24	13	This sentence is not very clear: if we understand the processes well, why are the projections inconclusive? Or is it the interactions between the processes that are still not well understood? [Eric Brun, France]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
15391	24	11	24	13	Description for the case where net negative emissions continue would be helpful because many deep mitigation scenarios reach net negative emissions. [Junichi Tsutsui, Japan]	Rejected - limited evidence is available in the literature or the chapter to inform such statement
25887	24	11	24	13	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
130085	24	11	24	13	This section is quite information dense and complex. For the SPM, it would be best to delete this sentence. [Trigg Talley, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
44795	24	11	24	13	The last sentence of C1.4 could be omitted - it is a bit wordy and not very informative, and thus more hinders than enables a reader. [Markku Rummukainen, Sweden]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130083	24	11	24	14	"We understand the processes well but..." processes of carbon cycle? This sentence does not explain well enough why there are uncertainties. [Trigg Talley, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
101581	24	11			Change "We understand the processes well but models are" to "The processes are well understood, but models are" [Knut Nadelhoffer, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
130087	24	12	24	12	"after net zero" is unclear. [Trigg Talley, United States of America]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
50283	24	12	24	12	Suggested edit for clarity: We understand the processes well but models are inconclusive in their projections of the carbon cycle after net zero is theoretically realised' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
97329	24	12			Please provide information on the scenarios used for figure SPM.7.f, both in terms of peak warming and long-term emissions and their relevance for GMSLR. [Nicole Wilke, Germany]	Not applicable. The sea-level projections up to 2300 in figure SPM.8 are now using SSP1-2.6 and SSP5-8.5, which is now consistent with the other panels of the figure. Those scenarios are the only scenarios that have enough ice sheet simulations to make 2300 assessments.
41247	24	13	24	13	SPM.7: Is this the correct figure number? [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - no, it should be SPM.10
11609	24	16	24	16	"For mid- and high-emissions" - maybe "For moderate and high-emissions scenarios" is better? Or medium [Gerhard Krinner, France]	Not applicable. HS8.2 now focuses on SSP2-4.5 and SSP1-1.9 and SSP1-2.6. It no longer mentions SSP3-7.0 and SSP5-8.5.
131751	24	16	24	16	Which scenarios are the mid- and high-emissions scenarios? [Hans Poertner and WGII TSU, Germany]	accepted. wording and sentence changed to be explicit about which scenarios have been used
81915	24	16	24	16	Amend to "Oceanic, coastal and land sinks" to be inclusive of coastal wetland blue carbon options? Elsewhere "terrestrial sinks" are referred to as "land sinks". The division of sinks into "land" or "ocean" leaves uncertainty with how to use the information if you work in the areas of coastal wetland sinks. [Dan Zwartz, New Zealand]	Rejected. That would be inconsistent with figure SPM.7, which only shows the size and proportion of the land and ocean sinks
80125	24	16	24	16	It would be great if the mid and high-end emissions were defined, simply in a parentheses. High-end most probably is the 8.5, while mid-emission is the 4.5. [Lilian Fejes, Hungary]	accepted. wording changed to include reference to the scenarios underlying the assessment
44797	24	16	24	16	Does this not apply for low-emission scenarios? (Of course, if emissions cease, so will much of the sinks that respond to atmospheric changes in concentration. This may be implied, but it does not come very clearly across). [Markku Rummukainen, Sweden]	taken into account. wording and sentence changed to be clearer
27931	24	16	24	23	This paragraph need details for better understanding. Why carbon sinks will weaken from the second part of the century with the high emissions scenario? 1) CO2 fertilization effect? 2) Carbon flux between atmosphere to land ? Does that means a sinks saturation? [Eric Brun, France]	noted. In order to keep the text concise and considering the competing processes, no further explanation has been added, however, the TS provides this detail
130089	24	16	24	23	What about a mention of geo-engineering? [Trigg Talley, United States of America]	noted. reference to CDR has been removed
97331	24	16	24	23	Please explain the reasons for the weakening of the sink. [Nicole Wilke, Germany]	noted. In order to keep the text concise and considering the competing processes, no further explanation has been added, however, the TS provides this detail

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97333	24	16	24	23	<p>We kindly ask the authors to take into account the following comments and suggestions for C1.5:</p> <p>1) The paragraph lacks context of the nature of the emission scenarios. Of course the mid- and high-emission scenarios feature oceanic and terrestrial sinks throughout the 21st century, because they also exhibit much higher rates of excess CO₂ to be taken up (higher partial pressure of CO₂). Whereas low-emission scenarios feature net-zero emissions already before the middle of the century, hence, there is no excess CO₂ to be taken up. This weakening of the sinks is immanent. We request the authors to revise the paragraph accordingly and provide more reasoning behind about why sinks are declining. In this regard and to provide more context, it would be appreciated, if the authors could provide some insights about how sinks will change if mid- and high-emissions scenarios are followed by strong mitigation and net negative in emissions in following centuries to reach warming levels of 2°C or even less. There will also be a sink-to-source transition occur resulting in much stronger land and ocean carbon sources.</p> <p>2) About the timing, the TS states (TS-85:51-53), that for land sinks the transition occurs decades to a few centuries after CO₂ emissions become net negative. This is also presented in Figure TS.31. Therefore, we kindly request to verify the medium confidence level of the second part of the sentence (SPM-24:18-21) starting with and "become sources...". In particular, verification is needed since one could also perceive this sentence as if it is "very likely" that his transition will occur.</p> <p>3) We question the usage of the word "weaken" since it may be perceived as a problem that the sinks are weakening in low emissions scenarios, although it only means, that the balance of earth's carbon cycle will be restored. Please use "rate will decrease or decline" instead.</p> <p>4) We encourage the authors to use the language of the TS (TS-47:34-35) instead</p>	<p>noted. the paragraph has been revised to clarify the responses under low, mid and high emission scenarios. A detailed explanation for this behaviour is presented in the TS and the underlying chapter 5, but omitted here to keep the SPM concise and focused on the key findings of the report</p>
50277	24	16	24	23	<p>The finding in C1.5 that if atmospheric CO₂ levels are decreased, sinks will become sources towards the end of the 21st century could be misinterpreted as meaning that the decrease in atmospheric CO₂ damages their ability to act as sinks if emissions were to rise again, as opposed to their behaviour of opposing a change in concentration after some lag time. This should be clarified if possible. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]</p>	accepted. text has been revised
50279	24	16	24	23	<p>The statement in C1.5 that carbon sinks will become sources towards the end of the 21st century is notconsistent with the underlying chapter 5, which states that "The ocean remains a sink of CO₂ for centuries after emissions become net negative". While it may be true that some sinks will become sources by the last 21st century, and that they will do so in aggregate, the land and ocean sinks should be separated out here to avoid confusion. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]</p>	accepted. text has been revised and made consistent with Chapter 5
131753	24	16	24	23	<p>The concept of ocean and land carbon sinks is introduced here without an indication of their size or importance [Hans Poertner and WGII TSU, Germany]</p>	accepted. structure of paragraphs changed so that first the concept of sinks are introduced before future changes are discussed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86971	24	16	24	23	Please consider to include estimate of what level of CDR is assumed in this scenario, in the order of 1, 5, 10 or 20 GtCO ₂ annual net removal 2050-2100. Please also consider to include estimate of net natural sink from oceans and terrestrial ecosystems, for example average annual uptake for terrestrial and ocean system 1995-2015. [Oyvind Christophersen, Norway]	taken into account. wording has been changed to remove a reference to CDR in this specific context. Text has been revised to include a reference to the average sink fraction for 1960-2019 (period with highest quality of observations)
77047	24	16	24	23	This is very important but made obscure by the verbal construct used. There seems to be two reasons why the vitality of natural sinks decrease beyond 2050. This distinction should be clear. Again this is very important for policy. [Emer Griffin, Ireland]	accepted. wording and sentence changed. By rearranging paragraphs to focus first on present and then future sink under different scenarios, the statement should be clearer now
78629	24	17	24	18	No – rate of carbon uptake weakens in the SSP scenarios due to flattening or decreasing emissions. Climate feedbacks are secondary in driving the sink response to the emissions profile. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	accepted. text has been revised accordingly
101583	24	17			Change "rate" to "rates" [Knute Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
130091	24	18	24	18	Suggest using a different word than emerging, particularly because it is defined in earlier boxes. May cause confusion. [Trigg Talley, United States of America]	accepted. wording changed
32373	24	18	24	20	This sentence would be easier to read and understand if the SSP names were put after "dioxide removal" [Clemens Schwingshackl, Norway]	accepted. scenarios names added
9735	24	18	24	21	seems counterintuitive -- why do low-emission scenarios lead to sinks turning into sources? Maybe a word of explanation? [Jonathan Lynn, Switzerland]	noted. the underlying explanations are covered in the TS. In order to keep the SPM concise, no explanation has been given in the SPM.
37641	24	18	24	21	Why sinks weakening occur earlier in low-emission scenarios than in higher ones? [Masahide Kimoto, Japan]	noted. the sinks are partially driven by the excess CO ₂ in the atmosphere and are therefore dependent on the growth rate of atmospheric CO ₂
38933	24	18	24	21	Can the background and potential consequences of this process be elucidated a bit? Otherwise, some readers might conclude that reducing emissions also means reducing a sink function - and not reducing emissions means the sinks will continue to work. [Maike Nicolai, Germany]	accepted. Text has been revised accordingly. Also Figure 7 has been revised accordingly
104187	24	18	24	21	The 2nd sentence of C1.5 states that in scenario with deployment of carbon dioxide removal, carbon sinks will weaken in the short-term. Please provide explanations to this apparent paradox (incl. which CDR technologies it relates to). [Philippe Tulkens, Belgium]	noted. the reference to CDR has been dropped in this context to avoid confusion of natural land+ocean sink processes and CDR
25889	24	18	24	23	More information could be provided on the decline of carbon sinks under emissions scenarios other than low emissions. This information could be taken from Chapter 5, page 7 lines 32-36: " It is very likely that the global ocean sink will stop taking up more CO ₂ from the second part of the century under any emission scenario, at a level varying from about 4 to 6 PgC yr ⁻¹ . It is very likely that the land carbon sink will decline from mid-century onwards under high-emissions scenarios, but there is low confidence that the land will switch from being a sink to a source". [Don Alfonso Pino Maeso, Spain]	noted. Figure 7 has been revised to be more synergistic and provide an overview on the sink fractions across scenarios. To keep the SPM concise, no further details have been added to the text
54669	24	18	24	23	Unclear what the message is here that needs conveying to Policy-makers. Under strong mitigation scenarios, carbon sinks could become sources. This sounds alarming. Could this text include an explanation of whether these reduced natural sinks (and potential sources) have any implications for estimated carbon emission budgets in these mitigation scenarios. If the response of the carbon cycle to CDR is already accounted for in the modelled emissions paths, it would be helpful to know this. [Nancy Hamzawi, Canada]	accepted. wording and paragraphs have been revised accordingly

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42245	24	18			C1.5 L18: Could an example of "emerging climate feedbacks" be added? [Tina Christensen, Denmark]	accepted. text has been revised accordingly
27933	24	19	24	20	Regarding "accelerated by deployment of CDR": is this needed here? It adds confusion to the next part of the paragraph. [Eric Brun, France]	accepted. text revised accordingly
130093	24	20	24	20	What implications does this result have on mitigation strategies for carbon removal? "...it is very likely that carbon sinks will weaken in the near term (2020-2040) and become sources towards the end of the 21st century." [Trigg Talley, United States of America]	Taken into account. The text has been revised to remove an explicit reference to carbon mitigation strategies, as this section is about the natural carbon cycle response. H.S.13.5 outlines the consequence for mitigation scenarios.
42295	24	20	24	21	C1.5 L20-21; could an example or explanation be added on how a sink becomes a source? [Tina Christensen, Denmark]	noted. To keep the SPM concise, no further information is given in the SPM, but more details can be found in Ch 5
86587	24	20	24	21	Is it really very likely that carbon sinks will become sources? It's definitely not true for the ocean, and it's low confidence for the land (see chapter 5 ES) [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	accepted. wording and text has been revised to be consistent with TS and Chapter 5
23397	24	20	24	21	"...it is very likely that carbon sinks will weaken in the near term (2020-2040) and become sources towards the end of the 21st century (medium confidence)." I recommend to re phrase to: "...it is very likely that carbon sinks will weaken in the near term (2020-2040) and there is medium confidence that they become sources towards the end of the 21st century.", since, as it stands now it seems like the "medium confidence" also applies to the part of the sentence "it is very likely that carbon sinks will weaken in the near term". [Anna Amelia Sörensson, Argentina]	accepted. wording and sentence revised
104189	24	20	24	21	"it is very likely that carbon sinks will weaken in the near term (2020-2040)": This seems to assume an almost immediate deployment of CDR on a very substantial scale. Can that be "very likely"? Please elaborate. [Philippe Tulkens, Belgium]	accepted. wording and sentences revised, references to CDR in this context removed
44799	24	20	24	21	This may risk being misunderstood. Uptake is conditional of emissions, so the carbon sinks do not just weaken, but the uptake scales with incr/decr emissions, and for neg emissions changes into a source when carbon dioxide is removed from the atmosphere. Additional clarity would be useful. [Markku Rummukainen, Sweden]	accepted. the entire paragraph has been revised
27935	24	21	24	21	Why will carbon sinks become sources only for low-emissions scenarios? [Eric Brun, France]	noted. In high emission scenarios, model project larger increases in land and ocean uptake due to CO2 induced feedbacks than sink declines through carbon-climate feedbacks or weakening carbon-concentration feedbacks
77603	24	21	24	21	Footnote required to explain meaning of 'equilibrium climate sensitivity and 'transient climate response' [Emer Griffin, Ireland]	Taken into account. Footnote 13 in the FGD explains what climate sensitivity is and the reference to transient climate response has been removed from the revised SPM
40529	24	21	24	21	Minor point: note that near-term is defined on page 24 as 2021-2040, and here as 2020-2040. [TSU WGI, France]	accepted, reference to near-term removed in text
131755	24	21	24	21	While carbon sink is in the glossary, carbon source is not [Hans Poertner and WGII TSU, Germany]	Noted.
77605	24	21	24	40	C.1.6 and C.1.7 messages are mixed and suggest redrafting them together to align key information [Emer Griffin, Ireland]	Taken into account. Those 2 bullets have been completely rewritten (HS4.4 and HS4.5) to clarify the message and align key information.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78631	24	21			Yes, carbon sinks will weaken, but not necessarily become sources – the timescales for this can be longer. Need to carefully cross-check this statement with the section 5.6 [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	accepted. text revised to be consistent with chapter 5 and the TS
36177	24	21			Having 'sinks' becoming 'sources' is not clear usage and seems an oxymoron. the 'land/ocean sink' wil become a 'land/ocean source' --please spell it out. OR, you could just say "these sinks" and drop the 'carbon' [Michael PRATHER, United States of America]	accepted. wording revised
36179	24	22			model response uncertainty' is not a well understood term - just drop the 'response' [Michael PRATHER, United States of America]	accepted. wording changed
77049	24	24	24	32	The key information is contained between line 30 to 32. This is very important and perhaps should frame this section rather than coming at the end. Consider moving this to the start. [Emer Griffin, Ireland]	Taken into account. Those 2 bullets have been completely rewritten (HS4.4 and HS4.5) to clarify the message and align key information.
77051	24	24	24	32	The end of section c.1.6. runs into the explanation for the increase in sensitivity. Perhaps combine these as a starting point and headline for this section. [Emer Griffin, Ireland]	Taken into account. Bullets are reworded
77053	24	24	24	32	The discussion of CMIP 5 and 6 is of academic interest but redundant here. [Emer Griffin, Ireland]	Taken into account. CMIP5 no longer mentioned here and bullet point HS4.5 simplified to highlight more what matters most to policy-makers.
80409	24	25	24	25	TCRE and TCR should be more clearly defined for the sake of clarity of the difference between both terms. Also, ECS should be defined for a non-scientific public [Paola Arias, Colombia]	Taken into account. TCRE and ECS are now explained more simply (in HS13 and HS4) and TCR is no longer addressed in the text.
25891	24	25	24	25	It could be helpful to explain more in detail Equilibrium Climate Sensitivity (ECS) and Transient Climate Response (TCR) [Don Alfonso Pino Maeso, Spain]	Taken into account. TCRE and ECS are now explained more simply (in HS13 and HS4) and TCR is no longer addressed in the text.
130101	24	25	24	25	Equilibrium Climate Sensitivity (ECS) is not defined. C.1.6 references Box SPM.1, but there is no mention of ECS there. [Trigg Talley, United States of America]	Accepted. Text clarified. Footnote 13 of the FGD defines ECS.
131759	24	25	24	25	While transient climate response is in the glossary, equilibrium climate sensitivity is not, nor is it explained earlier in the SPM [Hans Poertner and WGII TSU, Germany]	Accepted. Equilibrium Climate sensitivity added to the glossary.
77567	24	25	24	25	Some discussion how why equilibrium climate sensitivity (ECS) and transient climate response (TCR) are important might be useful for the summary [Emer Griffin, Ireland]	Taken into account. This is addressed explicitly in the revised text for A4.5 in the Final Approved SPM.
50285	24	25	24	26	Explanation of the differences between equilibrium climate sensitivity and transient climate response - the LOS points the reader to Box SPM1 but TCRE and ECS seem to be missing here? Please could this be added to Box SPM1? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Simple explanations have been added
28161	24	25	24	27	We recommend to insert a short definition of ECS and TCR as it is done for TCRE in C1.4. It would facilitate the interpretation of the numbers by policy-makers and avoid them to consult the glossary. It would limit the risk of confusion between these very important concepts. The short definition might be added in a footnote or in Box SPM.1 which is not the case presently, in contradiction with the explicit reference to Box SPM.1. [Eric Brun, France]	Accepted. text clarified
44801	24	25	24	27	The first sentence of C1.6 can be deleted. ECS and TCR are surely in the glossary. [Markku Rummukainen , Sweden]	Taken into account, a brief explanation remains to address other comments.
17719	24	25	24	27	ECS and TCR is not included in Box SPM.1 as addressed. [Anette Jönsson, Sweden]	Not applicable. Box SPM.1 removed to shorten the SPM and focus on what matters most for policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131757	24	25	24	27	Both measures described here should be explained in short words; otherwise the whole key message is really difficult to understand. ECS could be explained as: the response of the global average surface temperature to a doubling of carbon dioxide - just as an AGU writer did here: https://doi.org/10.1029/2020EO141895 [Hans Poertner and WGII TSU, Germany]	Taken into account. The bullets on climate sensitivity have been moved to HS4 and are now explaining things more simply and focus on the most policy relevant aspects.
81891	24	25	24	27	The reference to Box SPM.1 doesn't seem justified. Is further content to be added? [Dan Zwartz, New Zealand]	Taken into account. Box SPM.1 and reference to box SPM.1 removed.
78633	24	25	24	31	This is both a high profile and important point (higher ECS in CMIP6 models). Suggest it needs more prominence – move it up and don't look like it's buried down at point number 6 in this section. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This point is discussed in Box SPM.1.3 in the Final Approved SPM.
130095	24	25	24	32	The ECS is not explained very well and should be defined or clarified. [Trigg Talley, United States of America]	Accepted. Text clarified. Footnote 13 of the FGD defines ECS.
50287	24	25	24	32	C.1.6 does not really highlight that uncertainty remains in ECS, as this does clearly come across in the WCRP paper on which this is based. It would be very helpful to say more about the higher end. Could a statement such as <10% of being above 5C be included? The reason this should be included is that high-end and high-impact is highlighted in section D. Suggest that TCR has its own bullet. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. For simplicity/brevity, TCR has been eliminated from the SPM. The assessment of ECS is presented in A4 of the Final Approved SPM, including the very likely range. Possibilities outside the very likely ECS range cannot be ruled out and are discussed in C3.
4561	24	25	24	32	The ECS is not in line with recent publications. Considering that CMIP-6 models have essentially failed for this report, it would be important to respect the literature findings of many groups that find ECS values of mostly below 2.2°C/2xCO2. How can the best estimate be 3°C? This is probably more a politically than scientifically chosen number as it does not reflect the current understanding of the majority of scientists. Consider the following papers which mostly have not been cited by the AR6: Otto, A., Otto, F. E. L., Boucher, O., Church, J., Hegerl, G., Forster, P. M., Gillett, N. P., Gregory, J., Johnson, G. C., Knutti, R., Lewis, N., Lohmann, U., Marotzke, J., Myhre, G., Shindell, D., Stevens, B., Allen, M. R. (2013): Energy budget constraints on climate response: Nature Geosci 6 (6), 415-416. Mauritsen, T., Stevens, B. (2015): Missing iris effect as a possible cause of muted hydrological change and high climate sensitivity in models: Nature Geosci 8 (5), 346-351. Bony, S., Stevens, B., Coppin, D., Becker, T., Reed, K. A., Voigt, A., Medeiros, B. (2016): Thermodynamic control of anvil cloud amount: Proceedings of the National Academy of Sciences 113 (32), 8927-8932. Mauritsen, T., Pincus, R. (2017): Committed warming inferred from observations: Nature Climate Change 7, 652-655. Lewis, N. (2013): An Objective Bayesian Improved Approach for Applying Optimal Fingerprint Techniques to Estimate Climate Sensitivity: Journal of Climate 26 (19), 7414-7429. Lewis, N., Curry, J. A. (2015): The implications for climate sensitivity of AR5 forcing and heat uptake estimates: Climate Dynamics 45 (3-4), 1009-1023. Lewis, N., Curry, J. (2018): The Impact of Recent Forcing and Ocean Heat Uptake Data on Estimates of Climate Sensitivity: Journal of Climate 31 (15), 6051-6071. van Hateren, J. H. (2013): A fractal climate response function can simulate global average temperature trends of the modern era and the past millennium: Climate Dynamics 40 (11-12), 2651-2670. Loehle, C. (2014): A minimal model for estimating climate sensitivity: Ecological Modelling 276, 80-84. Skeie, R. B., Berntsen, T., Aldrin, M., Holden, M., Myhre, G. (2014): A lower and more constrained estimate of climate sensitivity simulated by atmospheric and detailed land-use forcing simulations. Earth Syst	Rejected. The assessment is based on that in Chapter 7, where these and other papers are fully considered

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78819	24	25	24	32	C1.6: It is very good here to see an attempt to constrain the long-standing likely range of ECS (1.5-4.5K). However the quoted likely range here (2.5-4K), with a best estimate of 3K, is bizarrely asymmetric. I was expecting to see something more like 2-4K, which is much more defensible in my view. Emergent constraints based-on the trend in global warming show that models with high-sensitivities tend to overestimate warming over the last 50 years, which acts to constrain the upper likely range more than the lower likely range. It is therefore very surprising that the lower likely range has moved up more (from 1.5K to 2.5K) than the upper likely range has moved down (4.5K to 4K). [Peter Cox, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This is based on the assessment in Chapter 7 as detailed from the lines of evidence
81903	24	25	24	32	The very general descriptions of TCR and ECS provide insufficient context for the numbers that are then provided, which could lead to confusion about what they mean. [Dan Zwartz, New Zealand]	Taken into account. For brevity/simplicity, TCR is no longer mentioned in the revised SPM and ECS is now properly defined in footnote 13 of the FGD.
114941	24	25	24	32	You have a communication challenge here. Lay readers will not get that very likely means a larger range compared to likely. Rather they will think it is narrower range around the central estimate. I suggest you reformulate to make the nested nature of the confidence intervals more accessible to the lay reader. [Elmar Kriegler, Germany]	Accepted. text clarified and simplified
132621	24	25	24	42	This discussion of ECS and TCR should come at the beginning of this section, before projected warming is discussed since these ranges inform those projections. More is needed here about why these ranges are different from those in AR5, as it's a major update. [Kyle Armour, United States of America]	Not applicable. ECS is now discussed in HS4, which is about our improved understanding of the climate system, in the first section of our revised SPM (on the current state of the climate).
130097	24	25	24	42	[ACCESSIBILITY] Seems extremely dense and technical for an SPM. Given the length of the SPM already, for readability and accessibility, recommend combining sections C.1.6 and C.1.7, providing some numbers while also stating general ranges (C.1.7). [Trigg Talley, United States of America]	Accepted. Text clarified
130099	24	25	24	42	Paragraphs C.1.6 and C.1.7 are difficult to comprehend, largely because the terms "equilibrium climate sensitivity (ECS)" and "transient climate response (TCR)" are inadequately explained here and are also not defined in the Glossary. In order to make this information more useful to policymakers, ECS and TCR should be clearly defined, and their relationship to "low likelihood, high impact events" clarified. [Trigg Talley, United States of America]	Accepted. Text clarified
88899	24	25	24	42	As stated above, I think these paragraphs are better placed in section A.1. [Thorsten Mauritsen, Sweden]	Taken into account. ECS is now covered in HS4, which is about our improved understanding of the climate system, in the first section of our revised SPM (on the current state of the climate).
86973	24	25	24	42	Consider making messages clearer. [Oyvind Christophersen, Norway]	Taken into account. The bullets on climate sensitivity have been moved to HS4 and are now explaining things more simply and focus on the most policy relevant aspects.
104191	24	25	24	42	C1.6-1.7 SPM discussion of climate sensitivity should place the updated ECS & TCR estimates in a policy-relevant context. For example, include the insight from Section 4.3.4 that only very low emissions AND low-end sensitivity estimates can avoid crossing the 1.5°C threshold in the short-term. There is medium confidence that an ECS/TCR combination near the lower end of the assessed very likely range delays reaching 1.5°C to later than during the near-term for scenario SSP2-2.6 and avoids it altogether for scenario SSP1-1.9 (Table 4.6:). [Philippe Tulkens, Belgium]	Taken into account. The bullets on climate sensitivity have been moved to HS4 and are now explaining things more simply and focus on the most policy relevant aspects.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42365	24	25	24	45	C1.6 - 1.7 are quite technical in describing different models. Does this belong in SPM? [Tina Christensen, Denmark]	Taken into account. The bullets on climate sensitivity have been moved to HS4 and are now explaining things more simply and focus on the most policy relevant aspects.
36181	24	25			C.1.6 is very nice. It needs to come before C.1.4 that uses TCR in an very C-cycle specific way. I was worried when reading C.1.4 that TCR had not been discussed before. [Michael PRATHER, United States of America]	Taken into account. For brevity/simplicity, TCR is no longer mentioned in the revised SPM. TCRE has been moved to HS13, as it is important for the carbon budget. And the rest of the section has been reorganised, to improve the flow and readability of the SPM.
131761	24	26	24	27	Is the reference to Box SPM.1 correct? [Hans Poertner and WGII TSU, Germany]	Taken into account. Box SPM.1 and reference to box SPM.1 removed.
130103	24	27	24	27	Strike "of using observations" to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Accepted. text clarified and simplified
12669	24	27	24	27	It should not be SPM box1 [Lijing Cheng, China]	Taken into account. Box SPM.1 and reference to box SPM.1 removed.
9737	24	27	24	32	this will attract a lot of attention [Jonathan Lynn, Switzerland]	Noted.
53495	24	27			May be first remind the readers that in the AR5, the ECS likely range was 1.5° to 4.5°C (so that they understand that the range has been reduced but the lower bound has been increased by 1°C) [Hervé Douville, France]	Taken into account, text clarified and simplified
27937	24	28	24	28	Regarding the "strong agreement": "strong" seems a little bit exaggerated. There are still lots of question marks behind these estimates, and none of them is a direct assessment of ECS or TCR, following the CO2 definition. Better agreement would be more appropriate. [Eric Brun, France]	Taken into account, text clarified and simplified
130105	24	29	24	29	Strike "across access lines of evidence and to a reduction in uncertainty ranges" to help reduce the amount of text in the SPM. [Trigg Talley, United States of America]	Taken into account, text clarified and simplified
16059	24	29	24	29	"across assessed lines of evidence". Say what these lines of evidence are (in half a sentence!). [Daniel Lunt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, text clarified and simplified
101585	24	29			Change "to a reduction in uncertainty ranges" to "to narrowing of uncertainty ranges" [Knut Nadelhoffer, United States of America]	Taken into account, text clarified and simplified
11611	24	30	24	30	"The best estimate of ECS is 3°C" - suggest writing 3.0°C [Gerhard Krinner, France]	Rejected. without precision is preferable for the degree of confidence
130457	24	30	24	30	It is suggest change "The best estimate of ECS is 3C" to "The best estimate of ECS is close to 3C" as reflected in Ch7. [Panmao Zhai, China]	Taken into account, text clarified and simplified
87185	24	30	24	31	Please spell out/explain what 'the best estimate of ECS is 3°' means to aid the non-expert reader. [Oyvind Christophersen, Norway]	Taken into account, text clarified and simplified
86975	24	30	24	31	There has been a lot of media attention to the fact that ECS has been revised in CMIP6. The background for this is nicely explained in SOD FAQ 7.2, with Figure 1. Please consider to explain here, and/or in FAQ 5.4, why best estimate for ECS remains at 3°C. Please also consider to include paragraph where suitable, that could illustrate the importance/consequence of different levels of ECS. For example, please consider providing an example, illustrating how the carbon budget under a 2°C limitation, ≥66 pst likelihood, would be different under different assumptions of ECS (for example 2,3 & 4) and all other assumptions (of SLCFs and so forth) are held equal. [Oyvind Christophersen, Norway]	Taken into account. This would go into too much detail for an SPM, but is covered in the Chapter 7 text and FAQ
38935	24	30	24	32	Would it be possible to add the numbers from AR5 here for comparison? [Maik Nicolai, Germany]	Taken into account, text clarified and simplified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39537	24	30	24	32	ECS and TCR uncertainty ranges ignore a list of not less than 120 peer-reviewed papers which reports climate sensitivity equal or lower than 1°C: notrickszone.com/50-papers-low-sensitivity/ . This expert reviewer recommends a discussion of these findings, including prominent climatologists like S. Schneider who published in 1971 in Science a climate sensitivity of 0.8°C or R. Lindzen who published a similar value, and to revise the climate sensitivity range on the lowest side according to their conclusions. [François Gervais, France]	Rejected. The assessment is based on that in Chapter 7, where several lines of evidence are considered
80127	24	30	24	32	ECS and TCR are not explained fundamentally why they are useful and what are their differences. The text is not claiming for what period the ECS and TCR are defined, if not, why no time period is needed for these. Also, we believe that percentiles would be better to use instead of very likely and likely ranges. [Lilian Fejes, Hungary]	Taken into account. A brief explanation has been added
34993	24	30	24	42	The SOD estimates of ECS and TCR need to be viewed in the context that these are not based on CMIP6 models and may even be based only on group-think. Please see general comment #3 above, [Jim O'Brien, Ireland]	Rejected. The assessment is based on that in Chapter 7, where several lines of evidence are considered
44803	24	34	24	34	Is the "currently-available" a placeholder for the next draft? [Markku Rummukainen, Sweden]	Taken into account, text clarified and simplified
38937	24	34	24	34	Could be added how many model results are "currently available" and how many are still pending? [Maike Nicolai, Germany]	Not applicable. Bullet point rephrased 'currently available' no longer appears in the revised SPM.
69387	24	34	24	35	It would seem appropriate that TCRE is mentioned in C.1.7. Since it is understood that the values are not very much different from those of CMIP5, it is suggested that a phrase such as "while TCRE in CMIP6 remains approximately the same as in CMIP5..." be added in C.1.7. [Kaoru Magosaki, Japan]	Taken into account. TCRE is mentioned in HS13
27939	24	34	24	35	This sentence lets people think that this is true for all models, which is not the case, and is only true for a subset of models. The sentence should refer to the model ensemble or explicitly say the several models have (or most models have). [Eric Brun, France]	Taken into account. This point has been clarified in the revised text of Box SPM.1.3 in the Final Approved SPM.
107715	24	34	24	35	Only some CMIP6 models have higher ECS and TCR values than the CMIP5 models. The reference to average ECS and TCR values is confusing. The text should be amended to indicate "One subset of the currently available CMIP6 models have higher ECS and TCR values than the CMIP5 models." [Hunter Cutting, United States of America]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM.
3591	24	34	24	42	This explanation on the reason why CMIP 6 models were not used to estimate ECS (likely range and best estimate) is rather confusing. What I understand by reading Chapter 7 section 7.5 (SOD), the reason is CMIP 6 figures are quite different (higher) than CMIP 5 and seem not to explain the reality well. That is why "AR6 differs from previous reports in not directly using climate model values of ECS and TCR in the assessed ranges of climate sensitivity" (p. 104 lines 23-25 of Chapter 7). As a result authors used various figures of ECS (and TCR) calculated by several methodologies such as process understandings, warming over instrumental record, paleo climates, emergent constraints and obtained ECS (likely range and best estimate) by combining those figures (ref. Table 7.13). Please re-write lines 34-42 taking into consideration of those points. [Mitsutsune Yamaguchi, Japan]	Taken into account. Text revised. The discussion of CMIP6 and CMIP5 model climate sensitivity and their relation to projections is discussed in Box SPM.1 in the Final Approved SPM. The assessment of climate sensitivity is discussed in A4.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130107	24	34	24	42	Regarding the legend for Figure SPM.7, "Note that projected changes in GSAT are not based on raw model outputs, but on multiple and converging lines of evidence that enable to narrow the range of possible temperature outcomes..." With that in mind, is (a) in Figure SPM.7, the GSAT, consistent with parts b-g? Not if b-g come from the raw model output that is not being used for (a). [Trigg Talley, United States of America]	Taken into account. This figure has been revised substantially and appears as Figure SPM.8 in the Final Approved SPM. The basis of the projections in each case is made clear in the updated figure caption - panels a) and d) are based on constrained projections, and panels b) and c) on raw CMIP6 output. Further discussion on projection methods is presented in Box SPM.1.
90197	24	34	24	42	Paragraph C1.7 seems too technical for us for an SPM and should rather be included in the TS. [Georges Gehl, Luxembourg]	Taken into account. HS4.5 has been simplified, highlighting what is most policy relevant.
50289	24	34	24	42	Suggest C.1.7 includes a clear statement that the headline advice on ECS is not coming from the GCMs. Does the last sentence imply the models that have lower agreement with observations are the high ECS models? Please clarify if this is possible at present and if this is based on a limited sample. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The basis of the assessment of ECS is presented in A4.4 and included in the headline statement of A4. The ECS of CMIP5/6 models and their ability to reproduce observed aspects of climate change are discussed in SPM Box.1 in the Final Approved SPM.
15043	24	34	24	42	Section C1.7 is an example of a section that needs to be re-written with less reliance on acronyms, and to clarify what expressions like 'biases in these clouds' mean. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. HS4.5 has been simplified, highlighting what is most policy relevant. The term 'biases in clouds' no longer appears.
4563	24	34	24	42	You need to be much more transparent here. Many CMIP-6 model results are not compatible with measurements. Be honest about this, politicians deserve to know this and need to be told that models should currently not be used for policy-making as leading modelers have already publicly stated. An open communication of these problems is the basis for re-gaining trust. Do not hide behind scientific language, tell the policy makers about this issue in plain and open words. [Sebastian Luening, Switzerland]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM, including the link between ECS assessment and projections of surface and ocean warming, and sea-level rise.
107995	24	34	24	42	C.1.7. This is a contentious issue and this communicates it very well. Probably it will get updated as literature is building fast on this topic, but hopefully the final draft will be as informative as the current version. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
78635	24	34			First sentence is clumsy. Sounds like all of CMIP6 is above all of CMIP5. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text has been revised. This topic is discussed in Box SPM.1 in the Final Approved SPM.
41319	24	34			This subsection will probably be of key interest to policy makers, given current the questions on CMIP6/ECS from these stakeholder groups. More and more studies have shown (e.g. Tokarska 2020) that CMIP6 models, if constrained to observed recent change, almost show now divergence from CMIP5 ECS/TCR. this should be made more clear. The last sentence, in particular, could be reformulated to capture this finding more prominently, instead of simply pointing to the inability of some models to reproduce the observed trend. [Alexander Nauels, Germany]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM.
38939	24	36	24	36	What is meant by "biases in these clouds"? Please explain. [Maike Nicolai, Germany]	Not applicable. this part has been removed from the revised SPM, to shorten the document.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54671	24	37	24	39	Recommend splitting lines 38 and 39 into separate sentences to avoid merging messages that are better kept separate: 1. that CMIP6 ECS and TCR ranges span the assessed very likely ranges (just presented above in para C.1.6), 2. that the models project a range of warming that is wider than the assessed very likely ranges for warming (based on multiple lines of evidence) as presented in Box SPM.2 Table 1. Add cross-reference to that table here otherwise it is very unclear which assessed very likely ranges are being referred to. [Nancy Hamzawi, Canada]	Taken into account. The text has been revised and lines 38 and 39 are discussed in Box SPM.1 of the Final Approved SPM. A cross-reference to Table SPM.1 has been added to all statements in B1, which focuses on projections of global surface temperature rise.
16057	24	37	24	39	"ECS and TCR ranges from CMIP6 models however span the assessed very likely ranges". It does not follow from this that "the models to project a range of future warming that is wider than the assessed warming range based on multiple lines of evidence". So maybe remove "leading to". In my understanding "span" means equal to, not greater than. [Daniel Lunt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM.
80129	24	37	24	42	The second part of this paragraph could be revised to convey a more clear message. It is not fully understood of what assessed ranges do ECS and TCR span and of what assessed ranges do models overcome. Also, it is not clear from what exactly be excluded the high-risk, low-likelihood futures. [Lilian Fejes, Hungary]	Taken into account. HS4.5 significantly revised and simplified to highlight what is most policy relevant.
44805	24	39	24	39	Is the "assessed warming range" for the likely or very likely range, or generic for any range? [Markku Rummukainen, Sweden]	Taken into account. Text clarified
38941	24	39	24	39	I think at the very latest, the "multiple lines of evidence" would have to be explained further here - if not earlier in this section. [Maike Nicolai, Germany]	Taken into account. Text clarified
31591	24	39	24	42	I understand chap 4 assesses those to be very unlikely. If so, that should be elevated here in addition to saying they are useful and cannot be excluded. [Jean-Baptiste SALLEE, France]	Not applicable. Sentence removed from revised SPM, to shorten the document.
78821	24	39	24	42	C1.7: I suggest replacing two sentences with: "The CMIP6 models with the highest ECS and TCR values tend to overestimate global warming over the last 50 years, and are therefore down-weighted in our assessment of these metrics. However, these models remain highly useful as they provide insights into high-risk, low-probability futures, and also help to define emergent constraints." [Peter Cox, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM, where the tendency of some models to overestimate the observed warming is discussed explicitly. Low-likelihood warming outcomes are discussed in section C3.
9509	24	40	24	40	Need to change 'high risk, low likelihood' to be consistent with 'low likelihood, high impact' phrasing on p3, lines 20-24. [Joelle Joelle Gergis, Australia]	Not applicable. Sentence removed from revised bullet point (HS4.5).
29419	24	40	24	40	ECS and TRC values [Joachim Fallmann, Germany]	Noted
81849	24	40			TCR [not TCRs] [Dan Zwartz, New Zealand]	Not applicable. Term 'TCR' no longer features in the SPM.
37643	24	41	24	41	Readers have to go to the original Ch to know which are "some"? [Masahide Kimoto, Japan]	Not applicable. Sentence removed from revised SPM
38943	24	41	24	41	What kind of "evidence" is referred to here? [Maike Nicolai, Germany]	Taken into account. The "evidence" is referring primarily to warming outside the likely range projections associated with high ECS values that cannot be ruled out. These aspects are discussed in C3 of the Final Approved SPM with traceback to underlying chapter sections indicated in the curly brackets {}.
6379	24	41	24	41	"inconsistent" might be more appropriate than "less consistent". [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Sentence removed from revised bullet point (HS4.5).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44807	24	41	24	42	The last sentence of C1.7 is unclear. "some", "less consistent" are vague expressions. Does this sentence triumph over the previous one or vice versa? [Markku Rummukainen, Sweden]	Taken into account. Sentence removed from revised bullet point (HS4.5).
27941	24	41	24	42	It sounds important that the fact that it might be possible to have the high warming values is not toned down. The last comment is important, but should come before. The recent changes are also not necessarily a good "analog" for future changes, because several forcings have similar orders of magnitude, which is not the case for the end of the century. [Eric Brun, France]	Taken into account. The text has been revised and these aspects are discussed in Box SPM.1 of the Final Approved SPM, where the tendency of some models to overestimate the observed warming is discussed explicitly. Low-likelihood warming outcomes are discussed in section C3.
111657	24	41	24	42	I couldn't find any supporting discussion for this sentence in Chapter 7. Furthermore I think it is potentially misleading. As discussed in several places in Chapter 7, the historical record does not place any strong constraints on the upper bound of ECS, so to raise a lack of consistency of some high sensitivity models with recent historical warming here risks the reader jumping to the erroneous conclusion that the lack of consistency is due to the ECS of those models being too high. Recently we have shown for one such model that the discrepancy in recent warming rates is more likely explained by the common error in the pattern effect over recent decades, than by the overall higher ECS of this model (M. Andrews et al JAMES 2020 https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2019MS001995). I have heard that similar analysis is in progress for other CMIP6 models. I suggest deleting this sentence. I would instead highlight the very important result of Ch 7 that the historical record does not help us to constrain the high end ECS estimate. Given the complexities of understanding the historical record (very well covered in Ch 7) it is easy to jump to the wrong conclusions. It's important that the SPM makes it clear what can and can't be deduced from the results. The rest of this paragraph does an excellent job in this respect! [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed from revised bullet point (HS4.5).
111793	24	41	24	42	Meaning of last sentence hard to grasp: If "some" are xyz, then what about the rest? And "less consistent" than what (models) exactly? [Oliver Geden, Germany]	Taken into account. Sentence removed from revised bullet point (HS4.5).
78637	24	41			"however, some are less consistent..." – this is very vague. Either be specific which ones and with which observations or drop it. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed from revised bullet point (HS4.5).
36183	24	41			some are less consistent with' -- this looks to be a useless statement, since I can conclude that some are more consistent. Can you make stronger statement, it would help. [Michael PRATHER, United States of America]	Taken into account. Sentence removed from revised bullet point (HS4.5).
32375	24	41			I would change to "some models are less consistent..." [Clemens Schwingshackl, Norway]	Taken into account. Sentence removed from revised bullet point (HS4.5).
35275	24	41			Change "some" to "most": Most models that have the higher warming than the CMIP-6 ones overpredict warming in recent decades, as shown by Hausfather et al. (2020). [patrick Michaels, United States of America]	Taken into account. Sentence removed from revised bullet point (HS4.5).
88901	24	42	23	42	Delete 'changes in' [Thorsten Mauritsen, Sweden]	Not applicable. Sentence removed from revised bullet point (HS4.5).
105593	24	42	24	42	The last sentence of C.1.7 make no sense. Presumably this is trying to say something about observed GSAT trends? Or maybe something about emergent constraints? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed from revised bullet point (HS4.5).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6381	24	42	24	42	Is "recent changes in global warming" really what is meant here, or is it just "recent global warming"? [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Sentence removed from revised bullet point (HS4.5).
69389	24	43	24	43	"XXX" in the footnote should be estimated. (for our reminder) [Kaoru Magosaki, Japan]	Not applicable. Footnote removed from revised SPM. However HS13.1 presents the TCRE estimate in both units PgC and GtCO ₂
116109	24		24		C1.5 is it possible to provide a quantitative estimate for the weakening uptake. [Valerie Masson-Delmotte, France]	accepted. Revised Figure 7 provides this information
77601	24		25		References to each scenario are not very clear and their impacts. Scenarios could be better understood with descriptive name such as in C.1.5 [Emer Griffin, Ireland]	Taken into account. Text completely rewritten.
65603	25	1	25	18	Suggest modification of the Figure for clarity: 1) Place sea level change 2100 -2250 in its own figure so all the frames in this figure have the same time span 2) Atmosphere to ocean carbon flux is difficult to understand. Suggest replacing with future ocean pH; or reverse the sense of y-axis so greater atmosphere-ocean C flux shows as more negative 3) for atmosphere to land C flux, similarly, we suggest reversing the y-axis [Kushla Munro, Australia]	Taken into account. 1) Sea level has been split to show up to 2100 in panel d and up to 2300 in panel e. 2-3) carbon fluxes are no longer displayed. 3)
10867	25	1	25	18	If the projections are not CMIP6 models, what about what is shown over the historical period. Are these also emulators also effectively tuned to the historical observational record? If so then the statement about showing models ability to match recent trends could be circular reasoning. [Gareth S Jones, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. As described in the caption, the projections combine scenario-based CMIP6 projections with results from an emulator. The historical values are CMIP6 simulations alone. There is no circular reasoning here.
42253	25	1			Fig SPM7 panel e: Remove thermosteric component - but consider adding other information on the components contributing to sea level rise. [Tina Christensen, Denmark]	Accepted. Thermosteric component has been removed.
28125	25	1			Regarding Figure SPM.7: - Concerning panel e, the display of thermosteric curves has very little added-value and might be a source of confusion for policy-makers since it is not a proxy of the projections of sea surface temperatures. - Concerning panel f, we encourage to add SSP scenarios if they are available at multi-century timescale before the cut-off date. - Concerning the legend, why is uncertainty only highlighted for some scenarios and not all? The legend should mention it. It should also mention SSP scenarios. - We find it confusing and difficult to justify that the GSAT curves and the other curves correspond to projections obtained from different methodologies. [Eric Brun, France]	Taken into account. 1) Thermosteric curves have been removed from panel e. 2) We now show the available SSPs to 2300 in panel f. 3) Plotting uncertainties on all of the SSPs produces too much overlapping. 4) Here we are reported on the latest literature. Some of that literature is based on multiple lines of evidence, e.g. for GSAT and GMSL, and hence it is shown here.
130109	25	3	25	3	Not sure this section needs "The purpose of this figure" [Trigg Talley, United States of America]	Accepted. This text has been removed.
90775	25	3	25	7	Will this italicized text be included in the caption of Fig. SPM.7? [José Romero, Switzerland]	Accepted. The italicized text has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41321	25	3			Figure SPM.7: It is unclear why the focus is on SSP1-26 instead of SSP1-19. SSP1-19 is the only PA consistent pathway and therefore of utmost policy relevance. Policy makers would want to know the uncertainty ranges of SSP1-19 projections much more than SSP1-26. The readers is not interested in TIER1/2 distinctions if that is the reason behind showing SSP1-26. For improved clarity, I suggest to show SLR at the bottom - since it's the only "two-panel" variable - and connect both panels with a lightly shaded cone (from 1m left to 1m right). And it is not clear at all why long-term SLR is only shown until 2250. Surely, it can be provided out to 2300 like in SROCC. Please revise. [Alexander Nauels, Germany]	Taken into account. SSP1-1.9 is included where possible. SLR is shown to 2300 now in panel e.
99219	25	6			the source of the carbon during the PETM is still heavily under debate, could lithosphere be exchanged with reservoirs so that the text stands the test of time? [Daniela Schmidt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The carbon flux panels have been removed.
86589	25	9	25	9	Same comment as before: GSAT is NOT observed. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Corrected.
20945	25	9	25	10	is GSAT representing Global Surface Air Temperature or Mean Global Air Surface Temperature or Global mean near-surface temperature? Are they equivalent. We suggest this need to be applied consistently to avoid confusion [Ladislav Chang'a, United Republic of Tanzania]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
69391	25	9	25	16	Please note that "(f)" is used two times in the caption of Figure SPM.7, and the descriptions for (f) and (g) do not match those in the corresponding Figures. [Kaoru Magosaki, Japan]	Accepted. Corrected.
86471	25	9	25	16	Figure SPM7 caption. Panels (f) and (g) are referred to in this caption as sinks, whilst in the figure itself they are called fluxes. Sinks are better understandable for non-scientists. Please also use 'sink' instead of 'flux' in the figure. [Ala Taimar, Estonia]	Taken into account. Carbon fluxes are no longer displayed.
20943	25	9	25	16	Not clear what is meant by observed and projected time series in Figure SPM7. How do you project the time series? [Ladislav Chang'a, United Republic of Tanzania]	Accepted. This wording has been corrected.
26349	25	9	25	16	Why is there a blue interval in first colobar ('Temperature anomaly °C) in Figure SPM.7 ? Suggestion: change to white. [María Santolaria-Otín, France]	Not applicable. There is no colorbar in (former) figure SPM.7.
99985	25	9			Can authors please specify if they are using constrained CMIP6 data for the presented GSAT projections, as done in Box SPM.2. Also here, constrained CMIP6 data (that is able to capture recent temperature trends) should be used in order to avoid presenting a potential overestimation of future warming. [Caroline Eugene, Saint Lucia]	Taken into account. Multiple lines of evidence, including observational constraints on past warming, have been used for the GSAT projections.
68807	25	9			Please specify if you are using constrained CMIP6 data for the presented GSAT projections, as done in Box SPM 2. Constrained CMIP6 data should be used in order to avoid presenting a potential overestimation of future warming. [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Multiple lines of evidence, including observational constraints on past warming, have been used for the GSAT projections.
44073	25	10			What is the model basis for the presented GSAT projections? Given the inability of some CMIP6 models to capture recent warming trends, it has to be made sure that only the constrained CMIP6 information is used here. Please be clear in the caption that this is the case. [Lamin Mai Touray, Gambia]	Taken into account. The revised caption makes this clear.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77571	25	13	25	13	"(f) Annual carbon sink, (g) Annual land carbon sink" should read "(g) Annual carbon sink, (h) Annual land carbon sink" [Emer Griffin, Ireland]	Taken into account. Carbon fluxes are no longer displayed.
64799	25	13	25	13	(f) Annual ocean carbon sink and (g) Annual land carbon sink should be revised to "(g) and (h)" respectively [Casey Kopcho, United States of America]	Taken into account. Carbon fluxes are no longer displayed.
81917	25	13	25	13	Be explicit if "ocean carbon sink" includes coastal sinks such as mangroves, saltmarsh and seagrass ("blue carbon")? Are these coastal wetland sinks captured under "ocean" or "land" or are they absent? [Dan Zwartz, New Zealand]	Taken into account. Carbon fluxes are no longer displayed.
111477	25	15	25	15	Change "to narrow" to "narrowing of" [James Renwick, New Zealand]	Taken into account. This phase no longer exists.
42035	25	18	25	18	FIG SPM. 7: Please, remove four symbols on left to make more space for figure panels. [Juhani Damski, Finland]	Taken into account. These symbols no longer exist.
86133	25	21	25	21	An important message in this section is to differentiate clearly between committed changes resulting from emissions as they stand today (which is irreversible to some extent, or at least until at some point negative emissions can get us back to this point), and further changes from future emissions. Is it possible to display this graphically, i.e. future projections made up of these two components? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. In the revised SPM, HS6 is focusing on future changes that are roughly proportional to global warming levels while HS9 is about irreversibility/committed changes.
80471	25	21	26	28	there is hardly any reference to the possibility of accelerated Antarctic ice sheet mass loss and the risk of meters of SLR to 2300, as described in SROCC (see for instance fig SPM .1, page 7 of SROCC). Either please explain why these graphs are not longer valid or incorporate updated findings. In a worst case scenario, the Antarctic ice loss could seriously endanger the survival of the Netherlands and many other low lying heavily populated areas. [Leo Meyer, Netherlands]	Accepted. This is now included in HS9.2 referring to 9.4 and Box 9.4.
117231	25	21	26	28	All the conclusion in this section of future ocean, cryosphere and sea level changes are global (including figures). Is there nothing at regional level that can be said? I would be a lot more meaningful to be able to say something about exposure to sea level rise...I guess that is assessed in WG2 and we will have to wait for the SYR for that assessment. Still would be nice to show a map somewhere. [Maisa Rojas, Chile]	Accepted. HS9.3 discusses the number of locations that will experience extreme sea level events by 2100.
81919	25	21	26	28	Could section C.2 include a statement about the southern hemisphere cryosphere other than Antarctica? [Dan Zwartz, New Zealand]	Accepted. HS6.5 refers to low confidence in projected decreases in Antarctic sea ice.
87295	25	21	26	28	This is very policy relevant. There is hardly any reference to the possibility of accelerated Antarctic ice sheet mass loss and the risk of meters of SLR to 2300, as described in SROCC (see for instance fig SPM.1, page 7 of SROCC). Either please explain why these graphs are not longer valid or incorporate updated findings. In a worst case scenario, the Antarctic ice loss could seriously endanger the survival of the Netherlands and many other low lying heavily populated areas. [Marcel Berk, Netherlands]	Accepted. This is now included in HS9.2 referring to 9.4 and Box 9.4.
111659	25	21	26	29	There is nothing in this section on projected changes in the AMOC. I think there ought to be as many readers will be interested. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. AMOC is now covered in HS12.4
78639	25	21			The paragraphs are in a strange order – e.g. could you put GMSL after ocean T, and then permafrost afterwards – keep same order as earlier sections. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The contents of this section have been split between HS6.5 which includes permafrost and HS9 which focuses on the irreversible aspects related to deep ocean heat content, glaciers and ice sheets and sea level

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
106699	25	23	25	23	Since AR5, progress has been made in narrowing uncertainties in future glacier and ice sheet mass losses. I would argue that this sentence is not correct at least for the Antarctic ice sheet. Given the range of numerical ice-sheet models and the incorporation of new (instability) mechanisms in these models, the uncertainty in the projections of the future Antarctic ice-sheet mass loss is now broader than in AR5 (in which dynamical ice losses were poorly modeled). [Kevin Bulthuis, United States of America]	Taken into account. Following revision of chapter 9 in response to comments, this statement has been removed.
131763	25	23	25	24	the first sentence could be moved to C2.4 [Hans Poertner and WGII TSU, Germany]	Not applicable. Narrowing uncertainties has been removed from SPM.
40347	25	23	25	26	High confidence statement, but no time period is given. [TSU WGI, France]	Taken into account. This is better reflected in HS9.
77055	25	23	25	26	See earlier points on referencing AR5. it's better to collect these at the start. [Emer Griffin, Ireland]	Taken into account. This has been addressed in the revisions with AR5 referenced at the start of sections.
90199	25	23	25	32	Considering the significant progress made since the AR5 in the projections of sea-level rise, we would recommend a rewrite of the current headline along the following lines: "Depending on the emission scenario, a further sea-level rise of between 47 cm (21-84 cm) and 73 cm (50-107 cm) is expected by the end of this century. By the end of the 23rd century, a rise of a maximum of 15.5 m is estimated for high emissions. Sea levels will continue to rise for thousands of years thereafter, with the maximum temperature rise - not long-term stabilization - determining the degree of rise. On time scales of several millennia, rises of 8 metres per degree Celsius of maximum warming are assumed, which is considerably higher than the estimates in AR5. With a global warming of 2°C to 3°C, the Greenland ice sheet could reach a value at which the loss of mass remains irreversible for hundreds of years. A future loss of mass is probable for the Antarctic ice sheet, and in ambitious reduction scenarios a slight increase would be possible." [Georges Gehl, Luxembourg]	Taken into account. Although we haven't implemented the wording exactly as proposed, similar text now appears in HS9.3 and HS9.4.
130113	25	23	25	43	C.2.1 states with "medium confidence" that sea surface temperature increases during the 21st century will exceed "many hazard thresholds relevant to marine ecosystems." It seems that ocean acidification and deoxygenation pose even greater hazards to marine ecosystems. Thus WGI might consider adding the following statement at the end of C.2.1: "OCEAN ACIDIFICATION AND DEOXYGENATION WILL LIKELY EXCEED MANY HAZARD THRESHOLDS RELEVANT TO MARINE ECOSYSTEMS." In addition, these risks should be briefly and clearly mentioned in the Section C.2 pink box summary, after the second sentence and before the third, as follows: "...projected to increase (high confidence). OCEAN WARMING, ACIDIFICATION, AND DEOXYGENATION THREATEN TO DISRUPT MARINE ECOSYSTEMS (MEDIUM CONFIDENCE). For the Antarctic Ice Sheet, ..." [Trigg Talley, United States of America]	Rejected. Space constraints have not allowed this.
97335	25	23	26	9	Please provide more quantitative information in this headline statement C.2 and the subsection C.2.1-C.2.3 [Nicole Wilke, Germany]	Taken into account. HS9.1 includes more quantification. However, it is not possible within the space constraints to quantify all statements and the readers are referred to the relevant parts of the text for this.
7697	25	23	26	28	It is noted that this subchapter C.2 does not provide any information about the further warming of the ocean - compared to a baseline, or about the expected overall sea level rise by 2100 depending on the emissions scenario. It is strongly recommended to include explicitly such policy relevant information. [Klaus Radunsky, Austria]	Accepted. Scenario dependence of likely range sea level projections are given in HS9.3.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130111	25	23	26	28	An opening Arctic, as a result of melting sea ice, has national security implications for the U.S. If American policymakers do not take scientific predictions of sea ice into account, they will be unprepared. Rising sea levels, exacerbated by global ice melt, is the most clear threat to the existence of military installations and infrastructure around the world. Citation: http://www.andrew-holland.com/uploads/6/3/1/7/6317360/79-88_holland.pdf [Trigg Talley, United States of America]	Noted. A practically ice free Arctic is now described in HS6.5.
50291	25	23	26	28	In C2 and particularly C2.1, it would be helpful to more clearly separate out the impacts that will happen due to future emissions, regardless of future scenario, and those that will happen "even if all emissions stopped today", which would be a helpfully clear phrase to use, as "committed" is not a phrase that is always well-understood. For example, does the sentence "All future warming scenarios show committed sea-level rise of several metres after two millenia" refer to SLR committed from historical warming, from future warming up to 2100, or from warming after that point? The same question can apply to surface and subsurface warming in C2.1 It would be helpful to clarify this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This is now reflected in the revised headline of HS9
97337	25	23	27	50	The statement should also relate to the results of the SROCC. [Nicole Wilke, Germany]	Rejected. We have not included references to SROCC but chapter 9 in particular (where most of these results derive from) is fully traceable to SROCC.
131989	25	23		32	projections for hypoxia deserve being lifted to the headline statement as oxygen loss is the most effective drive of biodiversity loss in the ocean, this has been a debate in AR5, with increased confidence such thinking should be abandoned. [Hans Poertner and WGII TSU, Germany]	Rejected. This is part of HS9.1
36185	25	23			Again, 'narrowing uncertainty in future' ? what is meant is for a given scenario, say it, because otherwise a typical SPM reader may think from Fig SPM.7 that the spread in the lines here is reduced. [Michael PRATHER, United States of America]	Not applicable. The term 'narrowing uncertainties' has been removed.
36187	25	23			The C.2 headline bullet seems long-winded and hardly a headline. Can you just pick one or two big things and leave the rest for the bullets below? These word-heavy headlines are throughout and have finally just gotten to this reviewer. [Michael PRATHER, United States of America]	Taken into account. This has been rewritten as HS9 which has a clearer message.
46641	25	24	25	24	Please change "sea-ice extent" to "sea-ice area" for consistency with the primary metric in chapters 2, 4 and 9 [Dirk Notz, Germany]	Taken into account. HS6 does not refer to extent.
15449	25	24	25	24	"Arctic sea ice extent" is mentioned in the headline statements of Section C.2 but "Arctic sea ice area" is discussed in Section C.2.3 (P.26, line 1). Please consider harmonizing the terms used. [SAI MING LEE, China]	Taken into account. HS6 does not refer to extent.

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40823	25	24	25	24	SPM <-> TS: On sea-ice extent from the TS "Except for the Antarctic ice sheet, for which a slight mass gain in a warming climate cannot be excluded under strong mitigation scenarios, there is high confidence that future warming will lead to reduced extents and/or volumes of all other cryospheric elements of the climate system (sea ice, Greenland Ice Sheet, glaciers, permafrost and seasonal snow cover). Limited model resolution and poorly understood regional processes infer low confidence in regional projections of Antarctic sea-ice area. {9.3.1, 9.3.2, 3.4.1}" " Limited model resolution and poorly understood regional processes infer low confidence in regional projections of Antarctic sea-ice area (Figure TS.17b). {3.4.1, 9.3.1, 9.3.2}." Perhaps clarify in the SPM, "large scale sea-ice extent" or something similar? Noted that this is discussed in the next sentence, but if this one sentence is taken out of context.... [TSU WGI, France]	Taken into account. Low confidence in Antarctic sea ice is now mentioned in HS6.5
40825	25	24	25	24	SPM <-> TS: On snow cover the following is stated in the TS "Reductions in spring snow cover extent have occurred across the Northern Hemisphere since at least 1978 (very high confidence). {2.3.2, Cross-Chapter Box 2.1, Cross-Chapter Box 2.4}" Where is the evidence for the Southern Hemisphere to support this headline statement on snow cover extent? [TSU WGI, France]	Rejected. HS6.5 refers only to seasonal snow. This is acceptable because snow cover is dominated by Northern hemisphere (45 million km2 in N Hemisphere and 1 million km2 in S Hemisphere).
15771	25	24	25	24	I find it surprizing to refer to permafrost "volume" and not "surface area" or "temperature", which seem more appropriate that referring to permafrost "volume". This probably needs ome double-checking. [Samuel Morin, France]	Taken into account. HS6.5 now refers to permafrost thawing.
86977	25	24	25	26	Please consider to change the order of which these changes are listed. Currently, it is not apparant if the changes after Arc. and Ant. sea-ice extent also is valid for only these two regions. Maybe you could consider to delete "Arctic and Antarctic" since there are probably no specific area where sea-ice is currently projected to increase? [Oyvind Christophersen, Norway]	Taken into account. This has been rewritten in HS6.5
78967	25	26	25	32	We think that the long term effects deserve seperate headline statement, or if this takes to much space, short term details should not appear at all in the headline. The possibility of a mass gain in the Antarctic is very unclear an far too much details for an headline where it lacks contextual information (does it relate to the entire mass balance including glaciers or to accumulation ? is it short or long term ?). [Martine Vanderstraeten, Belgium]	Taken into account. The long term effects have been rewritten in HS9 (while fast responses are now in HS6.5)
10203	25	27	25	28	This is not the current ch, 9 assessment: "It is likely that the Antarctic ice sheet will contribute 0.12 (0.00-0.26) m to GMSL by 2100 with little scenario dependence, but there is deep uncertainty regarding the Antarctic contribution under the high emissions scenarios. " Slight mass gain cannot be excluded (though outside the likely range) across all scenarios. [Robert Kopp, United States of America]	Accepted. This statement has been removed.
36189	25	27			Please, if mass loss is only 'likely', then of course you cannot exclude the opposite. [Michael PRATHER, United States of America]	Accepted. We have removed the cannot exclude mass gain in revisions
50297	25	28	25	30	I thought previous papers suggested that the median for GIS collapse was +1.7 deg C c.f. pre-industrial? Please could you clarify why this is now 2-3 deg C warming? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. A temperature threshold is now no longer referred to in SPM. This is because following revision of chapter 9 in response to comments, a temperature threshold for the Greenland ice sheet is not thought to be the most appropriate framing.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
84133	25	28	25	30	other science on Greenland on less stability: "The report states, with medium confidence, that at an increased level of warming between 1.5 and 2 degrees Celsius, instabilities in the Antarctic ice sheet and/or the irreversible loss of the Greenland ice sheet could lead to multi-meter (greater than 6 feet) sea level rise over a time scale of hundreds to thousands of years." see https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter/ or https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change [Manfred Treber, Germany]	Not applicable. Temperature thresholds for the ice sheets are now no longer specifically mentioned.
87337	25	28	25	32	This information is relevant, but more relevant would be to mention differences in post 2100 SLR e.g. after 2 centuries. [Marcel Berk, Netherlands]	Taken into account. HS9 now includes centuries to millennia in the headline statement.
32885	25	28			Since there is a submitted paper (Gregory et al.) showing no threshold for the GIS, I think that the confidence level should be reassessed and we should consider whether this should be elevated to the SPM [Helene Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This text has now been removed from the SPM.
11615	25	29	25	30	Need to make clearer that the threshold needs to be exceeded for centuries [Gerhard Krinner, France]	Not applicable. Temperature thresholds for the ice sheets are now no longer specifically mentioned.
80133	25	30	25	31	Several metres of sea-level rise is possible in 200 years maybe but until 2100 max. 1 metre. We suggest not using several metres. Also, millennia might not be the correct word to cover the time-span of 200 years (also in C.2.5). [Lilian Fejes, Hungary]	Taken into account. Several meters has been removed and HS9 is more explicit on magnitude.
44809	25	30	25	31	The "after two millennia" comes quite abruptly here. Perhaps something like... "All future warming scenarios show committed sea-level rise over more than two millennia, ..." [Markku Rummukainen, Sweden]	Taken into account. The revised HS9 refers to centuries to millennia.
38945	25	30	25	31	"committed sea-level rise of several metres after two millennia" might be difficult to understand for those unfamiliar with the concept of "committed change". Please explain/expand. [Maike Nicolai, Germany]	Rejected. We have kept committed in HS9.4 as it is more self explanatory in that context.
111661	25	30	25	31	This is not true, even for SSP2.6 (see Fig. SPM.7). I guess it will be even less true when SSP1.9 is considered. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This has been changed to be more explicit that it refers to 2000 years in HS9.4
40819	25	30	25	31	SPM <-> TS: In the TS for 2°C warming level: 2°C :The committed sea level after two millennia will be 1 to 3 m GMSL rise per °C peak warming (low confidence). {9.2, 9.3, 9.4, 9.5, 9.6,}" 1-3 does not seem to be "several". Could this statement be edited to be more consistent with the TS, or is there an error in the TS? [TSU WGI, France]	Accepted. This has been changed to be more explicit in terms of paleo equivalents in HS9.4
34545	25	30	25	31	This sentence has a sensational sound to it and should probably be removed from the SPM. I cannot imagine there are many contemporary policymakers who are planning for two millenia into the future. Yes, there might have been exceptions in the past, like maybe the Pharaohs in ancient Egypt and the builders of the Great Wall in China, but I can't think of anyone with that foresight or resource base today. [Russell Vose, United States of America]	Taken into account. This text has been replaced by HS9.
25893	25	30	25	32	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
50299	25	30	25	32	Suggest this statement on committed sea-level rise is clarified to state that projected SLR continues EVEN if temperature stabilises. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This now appears in HS9.3

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131991	25	30		31	The projection of sea level rise over 2 millennia seems very conservative compared to the phrasing in SROCC, some statement on comparable timescales (2300) would be useful. [Hans Poertner and WGII TSU, Germany]	Accepted. Sea level rise in 2300 now appears in figure SPM.8
81427	25	31			Suggest adding the sentence about an ice free Arctic (SPM-26 Lines 5-7) here as this is a significant conclusion. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This now appears in HS6.5
25895	25	34	25	36	In addition to "marine ecosystems" it would be also useful to add "human societies". [Don Alfonso Pino Maeso, Spain]	Rejected. This text has been removed. However, ecosystems and societies is in many definitions used in AR6.
12671	25	34	25	42	First, surface temperature and ocean heat content should be splited, surface response to climate change is not delayed so it corresponds to cumulative carbon emission and more relevant to simple policy target/metric (i.e Paries Agreement). However, subsurface responses to climate change is delayed and committed for several centuries. There are fundermental differences between SST and OHC. [Lijing Cheng, China]	Accepted. Surface and fast cryosphere responses are now covered in HS6 and slow responses are in HS9.
8155	25	34	25	42	Suggest to provide numbers for all statements in C2.1. [Frank Dentener, Italy]	Taken into account. Where space permits, numbers have been added in HS9.
50293	25	34	25	43	It is unclear which scenarios are classed as 'medium-to-high'. It is helpful to refer to them in such a way, as opposed to relying on knowledge of the scenarios, though this should be traceable back to, for example, the table in box SPM.2 [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We now refer to scenarios explicitly.
104193	25	34	25	44	The first sentence of para C.2.1 ... resulting in the exceedance of many hazard thresholds relevant to marine ecosystems (medium confidence). Already GBO4 (2014) and more recently IPCC SROCC has been clear that exceeding 2°C will be beyond the viable limit of coral reefs. Therefore the attribution 'medium confidence' in this context seems misleading. Ocean acidification will mean that calcifying organisms such as corals cannot survive. Their skeleton will dissolve. Maybe this example should be added, because it is illustrative about what "exceedance of many hazard thresholds" means - important message for policy-makers. [Philippe Tulkens, Belgium]	Rejected. This is beyond the scope of WG1.
12675	25	34	26	50	Projected values should be included and compared with SROCC/AR5 [Lijing Cheng, China]	Rejected. There is insufficient space to compare with SROCC/AR5.
131765	25	35	25	36	the evidencance for exceeding ecosystems thresholds is in WGII - this could say with risks for marine ecosystems and cite 2.3.4 (not 2.3.3) [Hans Poertner and WGII TSU, Germany]	Rejected. Text removed.
107997	25	35			"centennial timescales" can be a bit ambiguous. 100 years? Or do you mean multi-centennial timescales? [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Where possible we are explicit on centennial or centennial to millennial timescales.
38947	25	36	25	36	Can the depths of "surface and subsurface ocean" be specified? [Maike Nicolai, Germany]	Not applicable. We no longer refer to subsurface ocean.
36191	25	36			Can you say anything (based on SROCC, AR5?) about more than ecosystems? how about people and the built environment. I do not think society is included in ecosystems. [Michael PRATHER, United States of America]	Rejected. This text has been removed. However, ecosystems and societies is in many definitions used in AR6.
41323	25	37	25	37	Why is post-2100 ocean warming only assessed as "likely"? There is no explicit Chapter 9 ES statement that would support this assessment. Please revisit. [Alexander Nauels, Germany]	Accepted. HS9.1 now refers to irreversible changes on centennial to millennial timescales.
10205	25	37	25	37	"at least" 1-2 centuries? [Robert Kopp, United States of America]	Not applicable. This has been changed to centennial to millennial timescales in HS9.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111663	25	37	25	38	Need to say what scenarios this is contingent on - or if true for all the representative SSPs. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This has been addressed in HS9.
80455	25	39	25	40	This statement is slightly confusing. Deoxygenation is primarily driven by changes in ocean circulation and OHC. Ocean acidification on the other hand is a direct consequence of enhanced CO2 uptake in the (sub)surface ocean. The sentence gives the impression that ocean deoxygenation is directly affected by CO2 levels (and by inference oceanic CO2 uptake), although it is merely an indirect consequence. It would suggest to make these points clearer to avoid any confusion. [Samuel Jaccard, Switzerland]	Taken into account. Revised text in HS9.1 reads: Ocean stratification (virtually certain), acidification (virtually certain) and deoxygenation (high confidence) will continue to increase in the 21st century, at a rate depending on the future emission scenario.
17501	25	40	25	43	Highly likely irreversible change' in the Southern Ocean by 2030... deserves further explanation. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This detail has been removed from the SPM.
87339	25	41	25	41	what are these irreversible changes? [Marcel Berk, Netherlands]	Taken into account. This detail has been removed from the SPM.
130115	25	41	25	41	Is "minimal oxygen zones" the correct phrase? Is "oxygen minimum zones" more correct? [Trigg Talley, United States of America]	Accepted. This sentence is however removed from SPM and we refer only to deoxygenation in HS9.
65605	25	41	25	41	Suggest using the term "irreversible" only with a time scale over which the term "irreversible" would apply: e.g. see p.26 line 14 "irreversible over centennial timescales" [Kushla Munro, Australia]	Accepted. This is now the case in HS9.
90777	25	41	25	41	What is the timescale of this irreversibility? [José Romero, Switzerland]	Taken into account. Timescales are now clear in HS9.
131767	25	41	25	42	not clear, irreversible change in what way? Irreversible hypoxia? [Hans Poertner and WGII TSU, Germany]	Not applicable. This sentence has been removed.
36193	25	41			Is it clear that the irreversible change is to the hypoxic zones? Othwise split this sentence. [Michael PRATHER, United States of America]	Rejected. This level of detail has been removed from the SPM.
27943	25	45	25	45	Please add "as carbon dioxide (CO2) or methane (CH4)" after "carbon release". [Eric Brun, France]	noted. This sentence has been revised and shortened
9739	25	45	25	50	should this include a figure for CH4 release from permafrost as well as CO2? Many people (well me) think permafrost is all about methane [Jonathan Lynn, Switzerland]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5
97339	25	45	25	50	How does this information compare to the SROCC? And will the net effect on the atmospheric concentration be dampened by CO2-uptake due to increased photosynthesis? [Nicole Wilke, Germany]	noted. this information is contained in the underlying Chapter 5, but too detailed for a concise SPM
90201	25	45	25	50	If the assessment allows giving a figure for projected CH4 releases, it should also be included here. [Georges Gehl, Luxembourg]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5
11617	25	45	25	50	First sentence of this paragraph might be more logical as second sentence. [Gerhard Krinner, France]	accepted. text revised and shortened
50295	25	45	25	50	Would it be possible to also include here an estimate for the amount of methane projected to be released from permafrost by 2100? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5
68231	25	45	25	50	Add that N2O is also emitted from permafrost. Wilkerson J., et al. (2019) Permafrost nitrous oxide emissions observed on a landscape scale using the airborne eddy-covariance method, ATMOS. CHEM. PHYS. 19:4257–4268. [Durwood Zaelke, United States of America]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5

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66727	25	45	25	50	Add that N2O is also emitted from permafrost. Wilkerson J., et al. (2019) Permafrost nitrous oxide emissions observed on a landscape scale using the airborne eddy-covariance method, ATMOS. CHEM. PHYS. 19:4257–4268. [Kristin Campbell, United States of America]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5
104195	25	45	25	51	This paragraph (C.2.2) mentions carbon release from permafrost. It would be useful to quantify the potential range of resulting emissions not only for CO2, but also for CH4. Whilst the partitioning between CO2 and CH4 is uncertain, CH4 is highly unlikely to be zero. [Philippe Tulkens, Belgium]	noted. this detail has not been added to maintain a concise SPM, but it is covered in Ch. 5
27945	25	47	25	47	The starting date is missing. We understand that it means "from now" but this "now" should be precised. [Eric Brun, France]	noted. this has been dropped from the SPM in order to keep it concise
50301	25	47	25	47	Suggested edit for clarity: 'top 3m of soil' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	noted. this has been dropped from the SPM in order to keep it concise
25897	25	47	25	48	The words "above preindustrial levels" could be added after "global levels up to 4°C" to provide a timeframe in accordance with chapter 9, page 6, lines 51-52.. [Don Alfonso Pino Maeso, Spain]	noted. this has been dropped from the SPM in order to keep it concise
131769	25	47	25	48	Does this mean that for 4C of warming, 75% of permafrost will be gone? If so, say so [Hans Poertner and WGII TSU, Germany]	noted. this has been dropped from the SPM in order to keep it concise
50303	25	48	25	48	Is it possible to say anything about projections of permafrost volume change beyond 4 degrees? Could you add 'and sensibly assume to continue to thaw at at least this rate beyond 4 degrees' if model projections are available to support this? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	noted. this has been dropped from the SPM in order to keep it concise
36195	25	48			pretty funny 25% x 4C = 100%, I guess the loss cannot increase afterward..... [Michael PRATHER, United States of America]	noted. this has been dropped from the SPM in order to keep it concise
80135	25	49	25	49	Is the cumulative CO2 value from permafrost much? Maybe mentioning the relative proportion would be better. [Lilian Fejes, Hungary]	accepted. text has been revised to clarify the relative importance
27947	25	49	25	49	In order to be understood by decision makers, this figure must be put in perspective against an easy-to-understand baseline (% of global annual anthropogenic CO2 emissions in 2018 for instance). [Eric Brun, France]	accepted. text has been revised to clarify the relative importance
50305	25	49	25	49	Is the '74 +/- 48 Gt CO2 released from permafrost per degree of global warming to 2100' factored into allowable carbon budgets? If not, it would be helpful to clarify this here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	noted. this assessment is considered in the calculation as explained in Ch. 5.5, Table 5.8
44811	25	49	25	50	Could something be added about continued release beyond 2100? [Markku Rummukainen , Sweden]	noted. To keep the SPM concise, this information has not been added
25899	25	49	25	50	According to chapter 9, page 8, lines 52-54 it seems that there are very slight different figures: "The release of CO2 from thawing permafrost alone is estimated to be responsible for about 75 GtCO2 (±50 GtCO2, 1-sigma range) per degree of additional warming of this overall range". Moreover, in chapter 5 page 7 lines 53-54 there is another figure: "An ensemble of models project feedbacks due to CO2 release from permafrost of 20 ± 13 PgC per degree of global warming by 2100" [Don Alfonso Pino Maeso, Spain]	noted. Estimates have been made consistent (but note the different units in the two chapters). text has been revised, estimates with low confidence have been removed for a concise SPM, the quantitative estimates are traceable to the TS and Chapter Box 5.1
97341	25	49	25	50	Instead of only providing this figure of 74 GtCO2 per degree of global warming with low confidence, we request to also include figures provided in the SROCC B1.4 of tens to hundreds of billion tons C with medium confidence. Therewith, the potential contribution of the permafrost becomes clearer as it would also cover potential CH4 emissions. [Nicole Wilke, Germany]	noted. Assessment is considering suggested literature as detailed in Chapter Box 5.1. For a concise SPM actual numbers with low confidence have been removed from the draft

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54673	25	49	25	50	Permafrost emissions quoted here are lower than other recent estimates in peer-reviewed literature, such as the Nature review paper of Schuur et al. (2015, doi:10.1038/nature14338). Related comments are provided for the related text in Chapter 5 with further clarification. [Nancy Hamzawi, Canada]	noted. Assessment is considering suggested literature as detailed in Chapter Box 5.1. For a concise SPM actual numbers with low confidence have been removed from the draft
5299	25	49	25	50	I suggest deleting the last sentence for brevity, as a vague statement that doesn't fit with the short message of this bullet (more intraseasonal variability). [Daniel Murphy, United States of America]	accepted. text has been revised to put permafrost feedback into context with emission scenarios. absolute numbers with low confidence have been removed
131771	25	49	25	50	This statement on the projected amount of CO2 release from permafrost might be more powerful if the amount is put in relation to other numbers [Hans Poertner and WGII TSU, Germany]	accepted. text has been revised to put permafrost feedback into context with emission scenarios. absolute numbers with low confidence have been removed
131773	25	49	25	50	could you give some content for the CO2 release, is it significant in terms of warming feedback? [Hans Poertner and WGII TSU, Germany]	accepted. text has been revised to put permafrost feedback into context with emission scenarios. absolute numbers with low confidence have been removed
86473	25	49	25	50	Please also provide similar figures for methane. [Ala Taimar, Estonia]	accepted. text has been revised to put permafrost feedback into context with emission scenarios. absolute numbers with low confidence have been removed
107491	25	49	25	50	Per the best practice established by Headline Statement A3 on risk assessment, the projections of cumulative CO2 release from permafrost should be expressed as a range of values, values falling into the very likely range. [Hunter Cutting, United States of America]	accepted. text has been revised to put permafrost feedback into context with emission scenarios. absolute numbers with low confidence have been removed
104197	25	50	25	50	What is the estimate for CH4 (corresponding to CO2)? [Philippe Tulkens, Belgium]	noted. Estimates are presented in TS and Chapter 5, but have omitted here for a concise SPM and the overall low confidence in the quantitative estimates
27949	25	50	25	50	This needs to be more detailed: does it mean "from 2018 to 2100"? [Eric Brun, France]	not applicable. text has been removed
8157	25	50	25	50	What is the estimate for CH4 (corresponding to CO2)? [Frank Dentener, Italy]	noted. Estimates are presented in TS and Chapter 5, but have omitted here for a concise SPM and the overall low confidence in the quantitative estimates
5293	26	1	26	1	"historically warmed less than the global average" is easier to read than "warmed slowly or slightly cooled" [Daniel Murphy, United States of America]	Not applicable. Former bullet C3.2 was removed from the revised SPM, to shorten the document.
53497	26	1	26	2	Sea-ice and snow cover are often quoted as variables for which pattern scaling is less suitable. May be "approximately proportional" is a bit vague and the SPM should rather warn against linear extrapolation of snow projections (with snow depth first increasing and then decreasing in high latitudes or at high altitudes)? [Hervé Douville, France]	Taken into account. HS6.5 states that additional warming will lead to the loss of cryosphere
83361	26	1	26	3	What about Antarctic sea ice also? Please add equivalent Antarctic sea ice information here. [Robert Massom, Australia]	Taken into account. HS6.5 states low confidence in the projected decrease of Antarctic sea ice
86979	26	1	26	3	Both the language used in the sentence itself, and the concept you are trying to communicate, is difficult to understand for policymakers. Please consider rephrasing. [Oyvind Christophersen, Norway]	Taken into account. HS6.5 completely rewritten.
87341	26	1	26	9	what are the committed changes from past temperature change? [Marcel Berk, Netherlands]	Taken into account. Committed change is referred to only for glaciers - change will continue for decades if temperature stabilises-in HS9.2

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
88447	26	1	26	13	The reference to remaining snow or ice volume doesn't really work for permafrost as it is an earth material so a mix of soil, rock, water and ice and thermal properties will determine rate at which thaw occurs. Also, permafrost thaw will continue beyond 3 m depth as permafrost can be 10s to 100s m thick so permafrost will continue to be lost even after all the permafrost in the upper 3 m is gone. [Sharon Smith, Canada]	Accepted. HS6 now discusses permafrost thawing.
50307	26	1	26	28	Please clarify in sections C2.3, C2.4 and C2.5 how these estimates compare to those reported in the SROCC. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There is insufficient space in the SPM to do this.
27951	26	2	26	2	The starting date is missing. We understand that it means "from now" but this "now" should be precised. [Eric Brun, France]	Not applicable. This sentence has been changed in HS6.5
131775	26	2	26	3	until remaining snow and ice becomes a major limitation for further proportional decline - what does this mean? [Hans Poertner and WGII TSU, Germany]	Taken into account. Phrasing no longer features in HS6.5
36197	26	2			until the remaining ...becomes a limitation' This makes no sense and begs the question of at what level does this decline stop? Also why not say the 'losses respond rapidly to the future lglobal warming...' then the contrast in the next sentence fits. [Michael PRATHER, United States of America]	Taken into account. Phrasing no longer features in HS6.5
101587	26	2			Change "ocean." to "oceans." [Knut Nadelhoffer, United States of America]	Editorial. Report to be professionally copy-edited prior to publication, this kind of issues will be fixed then, if not before
27953	26	3	26	4	The term "more slowly" is unclear. We suggest to replace it with "on a longer time scale". [Eric Brun, France]	Not applicable. Text no longer appears in this form.
36199	26	3			The sentence on lines 3-5 is really awkward to read, start by cleaning up the order of words: '... on a time scale of decades (glaciers) to millennia (ice sheets).. [Michael PRATHER, United States of America]	Not applicable. Text no longer appears in this form.
25901	26	5	26	5	We would like to have a detailed explanation of what is meant by "limited direct scaling of integrated mass loss with global warming levels" [Don Alfonso Pino Maeso, Spain]	Taken into account. This phrase is confusing and does not appear in chapter 9 so removed here.
25913	26	5	26	7	Chapter 9, page 6, lines 2-3 contain a slightly different drafting: "The Arctic Ocean is likely to become sea-ice free throughout September before cumulative future anthropogenic CO2 emissions reach 1000 GtCO2. (high confidence)" [Don Alfonso Pino Maeso, Spain]	Taken into account. Wording on sea ice free has been changed in HS6.5. The relation to carbon emissions has not been used as it does not apply to other parts of the cryosphere.
104199	26	5	26	9	The last two sentences of the paragraph seem to be inconsistent with each other. Please clarify. [Philippe Tulken, Belgium]	Accepted. Although these statements are both true, we appreciate the potential confusion. The statement elevated from chapter 9 to HS6.5 has been changed.
50321	26	6	26	6	Would it be possible to define 'sea ice free' in a footnote or provide a LOS to the Glossary, as this term may be interpreted to mean lacking any sea ice whatsoever. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been changed in HS6.5. However, this is a commonly used term and was defined in AR5.
82611	26	6	26	6	The main body of the report (e.g. 9.3, TS) uses a definition of "practically sea ice free" of an area of less than 1 million square km. The current SPM wording implies an area of zero, and should be amended to reflect the chapter findings. [Blair Trewin, Australia]	Not applicable. Text has been changed in HS6.5.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77573	26	6	26	7	"The Arctic Ocean is likely to become sea-ice free throughout September for the first time before 2050 for all emission scenarios (high confidence)." Does this statement hold true for SSP1-1.9 & SSP2.6? Fig SPM.7 suggests that September Arctic Sea, while in decline, still exists for the two lower SSPs. Maybe the "likely" projections may be much different (I don't have access) but I'd be surprised if the Arctic was "ice free" during September for SSP1-1.9 (& SSP1-2.6) [Emer Griffin, Ireland]	Taken into account. The potential confusion has been taken into account and reworded in HS6.5. However, a potential ice free Arctic in summer before 2050 is related to internal variability on top of the current decline.
39539	26	6	26	7	Please mention that the Danish Meteorological Bureau reports that, neglecting fluctuations, the sea Arctic VOLUME has not shown a significant decrease since 2007, contrary to the previous period. [François Gervais, France]	Rejected. Space does not allow this to be added in the SPM.
69393	26	6	26	8	The last two sentences in C.2.3 combined together could be interpreted to mean that it is not likely that the temperature rise is kept below 2 °C throughout this century, which touches upon the choice of future emission scenarios. Thus, in order to avoid being interpreted as policy-prescriptive, it is requested that the wording be reconsidered. [Kaoru Magosaki, Japan]	Accepted. Although these statements are both true, we appreciate the potential confusion. The statement elevated from chapter 9 to HS6.5 has been changed.
111665	26	6			Needs clarification. Do you mean 'ice free throughout a single September'? If you mean all septembers it looks inconsistent with Fig. 7 [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. It means at least once before 2050 (as internal variability plays a role here). Wording has been changed in HS6.5
27955	26	7	26	8	We suggest to reformulate the last 2 sentences in order to clarify that they address 2 different features. [Eric Brun, France]	Not applicable. Text has been changed in HS6.5.
54675	26	7	26	8	This last sentence seems to contradict the previous one although on a careful read these two sentences can be reconciled. To improve clarity and readability it might be helpful to start the last sentence on lines 7-8 with "However.....". [Nancy Hamzawi, Canada]	Not applicable. Text has been changed in HS6.5.
131777	26	8	26	9	SROCC SPM says 'for stabilised global warming of 1.5°C the annual probability of a sea ice free September by the end of century is approximately 1%, which rises to 10–35% for stabilised global warming of 2°C (high confidence)' - could you also add quantitative information? [Hans Poertner and WGII TSU, Germany]	Not applicable. Text has been changed in HS6.5.
74017	26	11	26	12	The statement as I understand is based on modeling data up to fall 2019. Given the recently 2020 published increased melting in Greenland, Arctic and Antarctica, as shown in recent studies, shouldn't these figures be reviewed? See: 1. https://www.nature.com/articles/s41467-020-15744-5 2. https://www.nature.com/articles/d41586-019-02653-x 3. https://www.nature.com/articles/s41586-019-1855-2 4. https://www.nature.com/articles/s41558-019-0677-4 5. https://www.nature.com/articles/s41598-019-53723-z 6. https://www.pnas.org/content/117/4/1877 7. https://sealevel.nasa.gov/news/183/greenland-antarctica-melting-six-times-faster-than-in-the-1990s 8. https://www.nature.com/articles/s41467-019-12808-z.pdf 9. https://www.nature.com/articles/s41612-020-0121-5.pdf [Sergiu Dov ROSEN, Israel]	Taken into account. Although figures have been removed from the SPM on ice sheet losses, the underlying chapter updates ice sheet loss estimates to 2020
27957	26	11	26	12	The starting date is missing. We understand that it means "from now" but this "now" should be precised. [Eric Brun, France]	Not applicable. This sentence has been removed from the SPM.
93763	26	11	26	19	It would be more policy-relevant to provide figures for SSP1-1.9 rather than for SSP1-2.6, as the former is most likely to be compatible with the Long-Term Temperature Goal of the Paris Agreement. [Quentin Lejeune, Germany]	Taken into account. Although ice sheet figures no longer shown, total sea level rise estimates include SSP1-1.9

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89421	26	11	26	19	"It is likely that the Antarctic ice sheet will contribute 0.12 (0.00-0.26) m to GMSL by 2100 with little scenario dependence [...]" -- Cross-ref with Chapter 9: This seems to contradict part of the literature: In particular, there are several studies that show a scenario-dependence (see for instance also Table 9.2): even within the ISMIP6 and LARMIP-2 intercomparisons referenced in Chapter 9, it has been shown that there is in fact a strong scenario dependence when considering simulations with higher melt sensitivities based on oceanographic studies (Reese et al. 2020). Further, the range (0.12 (0.00-0.26) m to GMSL by 2100) does not seem to reflect all findings summarized in Table 9.2. [Ricarda Winkelmann, Germany]	Not applicable. This sentence no longer appears in the SPM. However, these comments are relevant to the underlying text in chapter 9 where this has been addressed.
31565	26	11	26	19	Contribution to GMSL are useful. I think it would be worth adding a sentence somewhere (maybe in C2.4) to provide estimates of thermal expansion by 2100, to be directly comparable to GIS, AIS, and glacier contributions, and leading to C2.5 GMSL. [Jean-Baptiste SALLEE, France]	Taken into account. Numbers no longer provided for contributions in HS9 but the contribution is clear in HS9.1
50309	26	11	26	19	It should be made clear within C2.4 that ice sheet and glacier melt will continue after 2100, and if possible, give a timescale and magnitude for that continued change. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The long timescale is clear in HS9 as well as HS9.3
50311	26	11	26	19	The statement "glaciers will diminish even if climate stabilizes" is somewhat unclear, as it doesn't give an indication of whether this refers to climate stabilizing at current temperatures, or higher temperatures, nor how long they would continue to diminish for. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Timescale of decades is now in HS9.2
69395	26	11	26	28	Although both median and "likely" ranges of the contribution to GMSL by the Greenland ice sheet are given in C.2.4, only "likely" ranges of the level of rising the future GMSL is given in C.2.5. It would be better to present the numbers in the same way for explicitness. Inclusion of the medians is also consistent with the description in SROCC (Box SPM.2, Table 2, as well as in SPM B3.1). [Kaoru Magosaki, Japan]	Accepted. Values for ice sheet losses no longer appear in HS9 so inconsistency is removed.
130117	26	11	26	28	Recommend C.2.5 before C.2.4 -- that is, general statements about SLR before statements on Greenland/Antarctic contributions. [Trigg Talley, United States of America]	Rejected. We have chosen to discuss factors contributing to sea level rise and then total.
50313	26	11	26	28	Many of the ranges of sea level rise and sea level rise contributions in C2.4 and C2.5 are given without a mean figure, which would be helpful to also include (as has been done with, for example, the Greenland Ice Sheet numbers). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Given space constraints, ice sheet contributions have been removed and sea level is shown only as the likely range.
36201	26	11			contribute' could be simply 'add' - but then here and below in C.2.5, you need to say the beginning time from which you are measuring the 'add' [Michael PRATHER, United States of America]	Not applicable. This text has been changed in HS9 so exact numbers are not given.
53499	26	12	26	13	It might be better to choose a single warming level and to adjust the confidence level if needed. Knowing that we cannot exclude (low confidence) an irreversible decline of the Greenland Ice Sheet even for a +2°C warming level is a highly policy relevant statement. [Hervé Douville, France]	Rejected. The 2-3C range is used as this is consistent with underlying chapter 9 assessment which integrates a range of assessments for different parts of the climate system in the Executive Summary.
37645	26	12	26	14	Evidence? Improved(?) model simulations? [Masahide Kimoto, Japan]	Rejected. It is not possible to include the lines of evidence in the SPM. The reader is referred to the underlying text (9.4 in this case)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87297	26	14	26	15	The independency on SSPs regarding the contribution of Antarctica to SLR doesn't sound plausible given the acceleration of AA mass loss in the past decades. That suggest a temperature dependence and hence a scenario dependence. It is also at odds with SROCC (section B1.2: 0.04m and 0.12m under RCP2.6 and RCP8.5 respectively). This significant change should be motivated and/or reconsidered as it is an important issue for many countries. [Marcel Berk, Netherlands]	Taken into account. Numbers for ice sheet loss are not shown in the SPM due to space constraints but this is addressed in underlying chapter 9 text.
97343	26	14	26	16	"It is likely ... with little scenario dependence, but deep uncertainty ... under high emission scenarios". The but part is confusing with the 1st part of this sentence. Please formulate in a clearer way. [Nicole Wilke, Germany]	Accepted. Text has been rewritten.
130119	26	14	26	16	What does it mean that there is little scenario dependence? Is the range given not dependent on scenario, and physically, will it really not depend on scenario? [Trigg Talley, United States of America]	Taken into account. Numbers for ice sheet loss are not shown in the SPM due to space constraints but this is addressed in underlying chapter 9 text.
74083	26	14	26	16	The little scenario dependence does not reflect the state of literature. Most recent studies except ISMIP to my knowledge find scenario dependence. Ritz et al. 2015, Golledge et al 2015, Deconto and Pollard 2016 are some of them. They are also listed in Table 9.2, which is not in line with the statement here. [Matthias Mengel, Germany]	Taken into account. Numbers for ice sheet loss are not shown in the SPM due to space constraints but this is addressed in underlying chapter 9 text.
54677	26	14	26	16	Please clarify if the deep uncertainty related to the Antarctic ice sheet contribution to GMSL applies after 2100 or before 2100. Being explicit about this important conclusion would be helpful. [Nancy Hamzawi, Canada]	Accepted. This is now clear in HS9.2
106701	26	14	26	16	I find the whole sentence a bit unclear. The authors state at the beginning of the sentence that the contribution of the Antarctic ice sheet to sea level by the end of the century has little scenario dependence but the claim at the end of the sentence that there is deep uncertainty for the high emissions scenarios. Is there something missing? In the Technical Summary, the end of the sentence is "There is deep uncertainty regarding the Antarctic contribution beyond 2100 linked to potential destabilization of the West Antarctic ice sheet". It would make sense to also state this explanation in the summary for policymakers. [Kevin Bulthuis, United States of America]	Accepted. This is now made clear in HS9.2
76765	26	14	26	16	The little scenario dependence is based on ISMIP6 / Edwards while other studies in Table 9.2 indicate a scenario dependency. [Ronja Reese, Germany]	Taken into account. Numbers for ice sheet loss are not shown in the SPM due to space constraints but this is addressed in underlying chapter 9 text.
44813	26	15	26	16	Suggest breaking this into two sentences and explaining better how the "deep uncertainty" relates to what is said after "with little scenario dependence". [Markku Rummukainen, Sweden]	Accepted. This is now made clear in HS9.2
78969	26	15	26	16	This statement contradicts the sentence on mass gain in the headline statement C2, further illustrating that the headline statement as it stands can be misleading (here there is no mass gain, as the uncertainty range for the loss starts at 0). [Martine Vanderstraeten, Belgium]	Accepted. This confusion arises due to the use of likely or very likely range (numbers are likely range but obviously this is only 17-83rd percentile so mass gain is unlikely but cannot be ruled out in the distribution). Numbers have been removed from SPM and are explained in more detail in underlying chapter 9.
105597	26	15	26	21	Here is the SROCC ENSO statement for reference "Extreme El Niño and La Niña events are projected to likely increase in frequency in the 21st century and to likely intensify existing hazards, with drier or wetter responses in several regions across the globe. Extreme El Niño events are projected to occur about as twice as often under both RCP2.6 and RCP8.5 in the 21st century when compared to the 20th century (medium confidence)." [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable this bullet (C3.4) was removed from the SPM to shorten the document and focus on what is most policy-relevant.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104201	26	16	26	16	The term 'deep uncertainty' sketches a situation that we essentially do not know. Perhaps to spell this out, because not every policy maker will know the meaning of this. How to interpret the earlier mentioned ranges under deep uncertainty conditions? [Philippe Tulkens, Belgium]	Taken into account. Text has been revised in HS9.2 to reflect this.
37647	26	16	26	16	Is it OK to use "deep" uncertainty? [Masahide Kimoto, Japan]	Taken into account. Text has been revised in HS9.2 and although deep uncertainty used in chapter 9, not used here.
8159	26	16	26	16	The term 'deep uncertainty' sketches a situation that we essentially do not know. Perhaps to spell this out, because not every policy maker will know the meaning of this. How to interpret the earlier mentioned ranges under deep uncertainty conditions? [Frank Dentener, Italy]	Taken into account. Text has been revised in HS9.2 and although deep uncertainty used in chapter 9, not used here. The meaning and implications of the uncertainty should be clearer now.
44075	26	16			What is meant with 'deep uncertainty'? This concept remains very vague and unspecific. Please make an effort to better explain what this uncertainty term actually captures! And what would the consequences be in this context? If understood correctly, the sea-level rise projections would increase even further. If this is the case, please include this information. [Lamin Mai Touray, Gambia]	Taken into account. Text has been revised in HS9.2 and although deep uncertainty used in chapter 9, not used here. The meaning and implications should be clearer now.
111667	26	16			Here is a place where there is a missed opportunity for a storyline, as advertised as a step forward in the early SPM sections. Users will be desperate for information on such a scenario but even less information is provided than in previous ARs. 'Deep uncertainty' is not the same as 'we know nothing useful', and by saying nothing the authors leave a vacuum to be filled by others with less expertise. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. HS9.2 has been rewritten with the storyline.
99987	26	16			There is some underlying confusion with the concept of deep uncertainty. Is the deep uncertainty due information availability or is it because the literature is inconclusive. Can further clarification be given on the use of the term deep uncertainty? [Caroline Eugene, Saint Lucia]	Taken into account. Text has been revised in HS9.2 and although deep uncertainty used in chapter 9, not used here. The meaning and implications of the uncertainty should be clearer now.
68809	26	16			Please explicitly explain the concept of "deep uncertainty". [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Text has been revised in HS9.2 and although deep uncertainty used in chapter 9, not used here. The meaning and implications of the uncertainty should be clearer now.
97345	26	17	26	19	Please provide information about scenario dependence of disappearance of glaciers. [Nicole Wilke, Germany]	Taken into account. The text has been revised in HS9.2 and although no detailed scenario information in the SPM it is clear that glacier loss will continue for several decades even if global temperature stabilised. Details are in 9.5.
44077	26	17			LDCs also comprise mountaineous regions, for example the Himalayas, with vulnerable populations thatt are heavily reliant on up-to-date regional projections. Please expand on the regional glacier changes as this quantitative information is fundamentally important and has significant implications for a large part of the global population. [Lamin Mai Touray, Gambia]	Taken into account. We appreciate the importance of the regional information which is available for glaciers in 9.5 as well as chapter 12 and the Atlas. However, limited space in the SPM means that not all regions can be covered.
17589	26	21	26	22	Estimation for GMSL rise is too high for all scenario's and does not sufficiently reflect the current tide gauge trend of about 1,5-2 mm/yr. And the tide gauge measurements are most important for local coastal planning and projections for the future. [ferdinand meeus, Belgium]	Rejected. These estimates are not consistent with the assessment in underlying chapter 2.
54679	26	21	26	23	Space permitting, it would useful to say something brief here about why the projected likely range in GMSL for the highest emission scenario (SSP5-8.5) is considerably narrower, with a lower upper bound, than in SROCC (for RCP8.5). [Nancy Hamzawi, Canada]	Rejected. Space does not allow and reader is referred to 9.6 for this detail.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81851	26	21	26	23	The sentence would be easier to read and understand if it began with (instead of ending with) 'Between 1995-2014 and 2100' [Dan Zwartz, New Zealand]	Taken into account. Wording has been changed in HS9.3 to provide clarity.
93765	26	21	26	27	Same comment as above. Moreover, please also include the figures for SSP1-1.9 in the first sentence of this paragraph. [Quentin Lejeune, Germany]	Accepted.
77057	26	21	26	28	This is very technical and obscure. Could a small table be used? [Emer Griffin, Ireland]	Accepted. The number of scenarios described have been reduced in HS9.3
44815	26	21	26	28	Please add also SSP1-1.9 results, if available. [Markku Rummukainen, Sweden]	Accepted.
69397	26	21	26	28	We would like to suggest, for reducing the volume of the SPM, deleting the description of the level of the future GMSL in 2°C pathways (as the implication of the level of the future GMSL rise in pathways leading about 2°C seems to be similar to that under SSP1-2.6.) OR streamlining as appropriate the texts on the values of the corresponding GMSL for each of the scenarios (as the inclusion of the Figure SPM.7 would seem to be sufficient for the purpose). [Kaoru Magosaki, Japan]	Accepted. This has been simplified in last sentence of HS9.3 and shown to be consistent with paleo estimates in HS9.4
25903	26	21	26	28	For consistency purposes we would switch the order of paragraphs C.2.4 and C.2.5 so that C.2.5 becomes C.2.4 and viceversa [Don Alfonso Pino Maeso, Spain]	Rejected. We have chosen to keep the order so contributions lead to total sea level rise.
111669	26	21	26	28	There will be great interest in SSP1.9 as well. I encourage the authors to add this if possible. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted.
39541	26	21	26	28	Please mention that Parker, A., Ollier, C.D., 2015. Analysis of sea level time series. Phys. Science Int. J. 6, 119-130 report that sea level gauges show an average sea level rise of 1 mm per year. This would give 0.08 m in 2100 contrary to the statement. [François Gervais, France]	Rejected. Inconsistent with the body of evidence.
50315	26	21	26	28	Suggest C2.5 also considers mentioning high end SLR scenarios - the SROCC mentioned this with a clear statement on possibility of 2m by 2100. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This is now explicit in HS9.2
37801	26	21	26	28	As with other scenarios, we hope that the predictions for SSP1-1.9 will be provided. [Junhee Lee, Republic of Korea]	Accepted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104371	26	21	26	28	<p>The projection of sea level rise projections highlighted here for policy makers in the SPM is limited to model results. This is problematic as key processes of dynamic ice loss are still heavily parameterised in the vast majority of models [9.4.4.2].</p> <p>Expert elicitation [through, e.g. structured expert judgement (SEJ) studies] reports far higher levels of sea level rise than the model projections, indicating very low confidence in model projections. See Bamber et al 2019 as reported in Chapter 9.</p> <p>As such projections for policy makers should not focus on model results, but instead should include other lines of evidence as per SPM Headline Statement A3 which calls for risk assessment for policy makers to include multiple lines of evidence.</p> <p>Further, the projections offered in the text are limited to the (narrow) likely range, as opposed to the broader "very likely" range. [In the table both appear.]. This contradicts the best practice indicated by SPM statement A.3.4.</p> <p>This framing hides the considerable tail risk that most experts believe exists (as evidenced SEJ studies such as Bamber et al 2019.) that sea levels may rise much more this century than models suggest.</p> <p>Further this section fails to integrate the finding of deep uncertainty in the contribution Antarctic highlighted in the SPM statement C.6.4</p> <p>Per headline statement A3, policy makers need to be aware of high-impact, low probability situations, that would include "high impact" scenarios with "deep uncertainty."</p>	Taken into account. Underlying assessment in chapter 9 does include SEJ and assessment of changes greater than the likely range.
10207	26	21	26	28	Needs a caveat about deep uncertainty under high emissions scenarios, consistent with the Antarctic assessment. [Robert Kopp, United States of America]	Taken into account in fig SPM.8
89913	26	21			Trinidad and Tobago as a SIDS is of the view that even in the face of large uncertainties, quantitative SLR information post 2100 is essential provoking thoughts on the risks the country is exposed to aligned to the challenges embedded in already committed long-term SLR. In line with this , we will like to see more information on post-2100 SLR in figure SPM.7 in addition to enriching the underlying chapter 4 and 9 with more specific information, including with regard to SSP1-19. [Joanne Deoraj, Trinidad and Tobago]	Accepted. This now appears in figure SPM.8 and is clear at end of HS9.3
87139	26	21			SIDS are amongst the most vulnerable to sea level rise however long term information (post-2100) is not provided and is very critical to inform decision making. We are therefore asking that more information on post 2100 SLR be provided in particular for SSP1-1.9, in fig SPM7. [Jacqueline Spence, Jamaica]	Accepted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
99989	26	21			For SIDS, in particular, information on post-2100 SLR is crucial as regions are facing significant long-term SLR commitments already. Despite the large uncertainties involved, quantitative information is available that allows for highlighting the SLR risk that can be avoided when achieving a Paris Agreement consistent scenario. Grateful if more information can be provided on post-2100 SLR, including 2300 information, in particular for SSP1-19, in figure SPM.7, and boost the underlying chapter 4 and 9 ESs with more specific information. [Caroline Eugene, Saint Lucia]	Accepted.
42659	26	21			As for last comment but for GMSL. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Noted. However we cannot identify what this comment refers to, unfortunately. (Comments from all the reviewers get mixed and sorted by sections).
68811	26	21			Information on post-2100 SLR is crucial for SIDS. Already, regions are facing significant long-term SLR commitments. Although there may be large uncertainties involved, quantitative information is available that allows for highlighting the SLR risk that can be avoided when achieving a Paris Agreement consistent scenario. Please provide more information on post-2100 SLR, including 2300 information, in particular for SSP1-19, in Fig SPM 7. Further, underlying chapter 4 and 9 Executive Summary can more specific information. [Jeffers Cheryl, Saint Kitts and Nevis]	Accepted.
27959	26	22	26	23	SSP1-1.9 should be mentioned, even for saying that there are not enough information to provide a solid projection, which is the case. [Eric Brun, France]	Accepted
81853	26	24			Important for meaning and readability to insert a comma after 0.2m [Dan Zwartz, New Zealand]	Not applicable. Sentence no longer appears in SPM due to space constraint.
87343	26	26	26	27	why are there no SLR figures given for 2250 or 2300 like in the SR1.5? [Marcel Berk, Netherlands]	Taken into account. 2300 projections for GMSL are included in panel e of figure SPM.8
111671	26	26			2 deg C warming relative to when? Not clear as the SLR is measured relative to 1995-2014. This is one of the many places where the use of multiple baseline periods causes confusion. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Sentence no longer appears in SPM due to space constraint.
25905	26	27	26	27	The reference "1995-2014" should be replaced by "1996-2014" in accordance with chapter 9, page 8, lines 2-3. [Don Alfonso Pino Maeso, Spain]	Rejected. 1995-2014 is used in chapter 9.
111479	26	27	26	27	The word "will" at the end of this line should be something like "is estimated to", since these are projections, and confidence is low. [James Renwick, New Zealand]	Not applicable. This sentence no longer appears in the SPM.
10209	26	27	26	27	The assessment of committed warming is for peak warming up to 2°C; as written, could be read as applying for all levels of peak warming. [Robert Kopp, United States of America]	Not applicable. This sentence no longer appears in the SPM.
87299	26	27	26	28	The 2000yr committed SLR for peak warming between 1 and 2C is 1-3m/C, but for peak warming between >2C it is up to 6m/C! (Ch.9 p.99 l.8-20). One could question the confidence in this statement given the uncertain values in combination with the concluded independency of the AA mass loss on SSPs (see comment on SPM p.26 l.14-15). [Marcel Berk, Netherlands]	Not applicable. Sentence no longer appears in SPM due to space constraint.
42255	26	27	26	28	C2.5 L27-28 (and last sentence in headline statement): Important message, even with low confidence [Tina Christensen, Denmark]	Not applicable. Sentence no longer appears in SPM due to space constraint. However HS9.4 makes this point using paleo estimates.
97347	26	27	26	28	Please enhance the clarity of this statement to convey the important message that committed GMSLR depends on peak warming not on stabilisation. What does this mean for figure SPM.7.f? [Nicole Wilke, Germany]	Not applicable. Sentence no longer appears in SPM due to space constraint. However HS9.4 makes this point using paleo estimates. It is not possible to include this message in fig SPM.8

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41325	26	27	26	28	Post-2100 SLR is of existential importance to SIDS and other low-lying coastal regions and there is fundamentally important information missing in this single sentence. One of the most important messages regarding long-term SLR from the literature is that stringent mitigation in-line with the Paris Agreement may be able to limit mid-term SLR to around 1m, while higher emission scenarios commit us to multi-meter rise over the coming centuries (SROCC). This crucial long-term SLR avoidance message should be highlighted in the SPM. I would suggest to move all relevant post-2100 SLR information to a separate bullet. [Alexander Nauels, Germany]	Taken into account. This appears clearly in both HS9.3 and HS9.4
87345	26	28	26	28	What is meant by peak warming; where is this term explained? [Marcel Berk, Netherlands]	Not applicable. This sentence no longer appears in the SPM.
25907	26	28	26	28	It would be useful to have a detailed explanation for the concept "peak warming". [Don Alfonso Pino Maeso, Spain]	Not applicable. This sentence no longer appears in the SPM.
53501	26	28			You may also want to provide the range of absolute (unscaled) numbers so that the reader can fully appreciate this statement. [Hervé Douville, France]	Not applicable. This sentence no longer appears in the SPM.
78933	26	31	26	31	perhaps be more specific with: ... atmospheric circulation changes [Pedro Monteiro, South Africa]	Not applicable. Headline statement completely rewritten and merged with other previous headline statement.
31585	26	31	26	31	Should some space be made here for large-scale sea level patterns (that links to warming and circulation change) ? [Jean-Baptiste SALLEE, France]	Rejected. The section has been reduced (to save space and focus on what's most policy-relevant), rather than expanded.
90779	26	31	26	31	Write: "C.3 Future large-scale warming patterns and circulation changes" [José Romero, Switzerland]	Not applicable. The whole section C (now the 2nd section in the revised draft) has been completely reorganised and headline statement do not have headings anymore.
12677	26	31	27	28	Ocean is missing in this section: especially ocean warming pattern and ocean circulation changes besides of AMOC. [Lijing Cheng, China]	Rejected. Future changes in the ocean were covered in C2 (Future ocean, cryosphere and sea level changes) so it's not relevant to mention it in C3 (Large-scale warming patterns and circulation changes)
23391	26	31	30	29	General for C.3, C4 and C5: I think that these three sub-sections should put larger emphasis on the "possible futures" in the title of Section C (which is very differently and well done in C.1 and C.2). When I read the title of Section C I get the impression that C will describe different futures, and that which of these futures will occur (implicitly but well understood by all) depend on how humans change the radiative forcing from now on. But, reading the section C.3-5 I get the impression that these sub-sections only tell me "these changes will occur" and with which likelihood or confidence level. In some cases this could be resolved by separating scenario uncertainty from knowledge uncertainty. Whenever a confidence level is low or medium due to a scenario uncertainty there is a potential for telling the reader that "by causing less change in radiative forcing we can avoid this". [Anna Amelia Sörensson, Argentina]	Accepted. We have clarified this aspect in the revised SPM.
29201	26	33	26	33	The expression "Surface and atmospheric warming patterns and circulation" is not suitable. [Hiroshi Kanzawa, Japan]	Not applicable. Text has been changed in HS6.1.
38949	26	33	26	33	Could the expression "robust across scenarios" be replaced by a sentence that helps non-specialists understand what is meant by this? [Maike Nicolai, Germany]	Taken into account. Statement has been rephrased.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90781	26	33	26	33	Write: "Projected surface and atmospheric warming patterns and ..." [José Romero, Switzerland]	Not applicable. Text has been changed in HS6.1.
80137	26	33	26	34	Robust changes statistically mean that signal-to-noise ratio is over 2, but this is not the case for the warming in all regions. Maybe the text refers to the global surface warming (missing from the beginning of the text)? This is particularly not true for all seasons and years over the 21st century, so time horizon does not stand. [Lilian Fejes, Hungary]	Taken into account. Statement has been rephrased.
77059	26	33	26	40	This needs to be much clearer for policy. I assume climate zones are projected to move with impacts for temperatures and precipitation but [Emer Griffin, Ireland]	Taken into account. The statement is rephrased and more specifying how the changes increase as a function of the global warming level
9511	26	33	26	40	Awkward phrasing and grammar, needs work to be worthy of a SPM summary statement. Should robust just be 'stable' and time horizons just be 'projections'? Incorrect grammar should read 'including hot extremes'. Consider your audience when editing, cut down on the technical jargon. [Joelle Joelle Gergis, Australia]	Taken into account. Statement has been rephrased.
40815	26	33	26	40	SPM <-> TS: Could a TS call out be given for the "atmospheric warming" across scenarios and time horizons? [TSU WGI, France]	Not applicable. Text has been changed in HS6.1.
50317	26	33	26	40	There is improved understanding of the large-scale spatial patterns of temperature and circulation changes in response to global warming since the AR5' - suggest that this sentence would be more useful and policy relevant in WG1 if it includes details of the physical changes themselves rather than changes in knowledge and understanding. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Statement has been rephrased and a quantification is now included
89827	26	34	26	37	Please quantify "higher", "strong amplification" and "substantially larger" [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Statement has been rephrased and a quantification is now included
40837	26	36	26	36	SPM <-> TS: Would appreciate a link to the TS for this statement. "Summer-time warming" in the mid-latitudes for both NH and SH? [TSU WGI, France]	Taken into account. TS is now in the line of sight.
6383	26	36	26	36	"for hot extremes" is unclear wording. It is not clear what is implied by indicating that hot extremes will be larger - the hot extremes could become hotter still, longer or more frequent, and one suspects all three. [Adrian Simmons, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Statement has been rephrased and specified that this is about the frequency and intensity.
90783	26	37	26	37	Write: "Projected changes in both tropical and ..." [José Romero, Switzerland]	Not applicable. Text has been changed in HS6.1.
44817	26	37	26	39	Unclear, as this doesn't tell what the changes are, or why this is significant. (What are the regional precipitation pattern changes?) [Markku Rummukainen, Sweden]	Not applicable. Text has been changed in HS6.1.
130123	26	37	26	39	The sentence "Changes in both tropical and extratropical atmospheric circulation, which affect regional precipitation patterns, are very likely driven by the slowly evolving surface warming pattern and the fast atmospheric adjustment of the CO2 radiative forcing" implies that forced changes dominate over internal variability, but this may not be the case for shorter time horizons (i.e., before about 2050), especially for the extra-tropical atmospheric circulation. Suggest adding some kind of qualifier to this sentence to indicate that this is only true of changes in the latter half of the 21st century, or stating that "changes" refers to forced changes, not changes that also arise from internal variability. [Trigg Talley, United States of America]	Not applicable. Text has been changed in HS6.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
81511	26	37	26	39	Recommend to break into 2 or more sentences to better explain the scenarios. [Ee Ling Lee, Malaysia]	Not applicable. Text has been changed in HS6.1.
54681	26	37	26	39	We would recommend replacing this text (about what is driving the future changes in atmospheric circulation) with text describing what the robust changes in circulation are. The first sentence of this headline refers to robust changes across scenarios and time horizons, but then these patterns are not described. [Nancy Hamzawi, Canada]	Not applicable. Text has been changed in HS6.1.
86981	26	37	26	39	Regarding the use of "slowly" and "fast" in this sentence. Please consider to use different and more precise language since these words can be very confusing without the proper context of time and need for urgency. Rationale: If a policymaker reads that projections are showing that we will be experiencing a slowly evolving surface warming pattern it might influence his or hers attention for urgency regarding climate change. Similarly fast atmospheric adjustment does not say much for a policymaker since he or she most probably do not have the expertise to understand what fast is in this context. Is it meant during a week, month, season, year etc.? In addition, is it needed to specify "tropical and extratropical". First and foremost, and especially regarding extratropical, is a term that most policymakers do not understand easily. Secondly, extratropical could be interpreted like everything outside the tropics, and therefore when saying tropical and extratropical the reader actually includes everything. Lastly, if results are showing that it is the circulation outside the polar regions that are changing, you could consider to say "Changes in atmospheric circulation, except over polar regions, which affect" [Oyvind Christophersen, Norway]	Not applicable. Text has been changed in HS6.1.
87257	26	37	26	40	There is no reference for the claim in the main report AR6 WGI that changes in atmospheric circulations is (also) driven by the fast atmospheric adjustment to the CO2 radiative forcing. Why only CO2? Other constituents may as well have fast atmospheric adjustments, e.g. aerosols. Please clarify, or give a proper reference in AR6 WGI, or skip. [Marcel Berk, Netherlands]	Not applicable. Text has been changed in HS6.1.
130121	26	37			While the pattern of surface warming is nicely described, the pattern of circulation change is not. Suggest a brief sentence be added that describes the pattern of circulation change that is projected to occur (e.g., jet stream shift, storm tracks, monsoon, Hadley Cell). [Trigg Talley, United States of America]	Rejected. This statement is limited to aspect that change as a function of GWL. This is not necessarily the case for circulation changes, which may be forcing dependent
41249	26	39	26	39	"fast" - I think Chapter 7, for good reasons, backed off from defining these adjustments on the basis of timescale, but relied instead on their independence from changes in surface temperature [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been changed in HS6.1.
38951	26	39	26	39	What is meant by "and the fast atmospheric adjustment to the CO2 radiative forcing"? Non-specialists might interpret this as an ability of the atmosphere to change in such a way that it can cope with increasing radiative forcing. Would "reaction" work here to focus a little more on the process and avoid the conclusion of a positive outcome (of the "adjustment process")? Please also see page 27 line 9. [Maike Nicolai, Germany]	Not applicable. Text has been changed in HS6.1.
25909	26	39	26	39	It would be useful to explain the concept of "atmospheric adjustment to the CO2 radiative forcing" [Don Alfonso Pino Maeso, Spain]	Not applicable. Text has been changed in HS6.1.
36203	26	39			Do aerosol changes play no role in this? only CO2? what about CH4 and O3 and N2O? [Michael PRATHER, United States of America]	Not applicable. Text has been changed in HS6.1.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130125	26	42	26	43	[ENSEMBLES] How can that be, if GSAT estimates had to throw out some raw model outputs? It would seem like there is now less understanding. [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111481	26	42	26	43	Change to "There is improved understanding since the AR5 of the large-scale spatial patterns of temperature and circulation changes in response to global warming." - we are not talking about the warming since the AR5. [James Renwick, New Zealand]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
105595	26	42	26	47	Could the land-sea warming ratio and Arctic amplification be quantified? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
50319	26	42	26	47	I would suggest that C3.1 should be rephrased to be in the future/conditional tense as it currently sounds like it is talking about observed, not projected changes. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
19545	26	42	27	28	The sentence on lines 42-43 is not homogeneous with the remaining part of section C3: while everywhere else this section reports on either properties or projected properties of changing climate, here one hears about performances of climate scientists. This of course deserves mentioning, but should rather be addressed in a separate paragraph. [philippe waldteufel, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
44819	26	43	26	43	What is the amplification in reference to? Global mean warming? Please reword for clarity. [Markku Rummukainen, Sweden]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
42661	26	44			Does the second part of this sentence refer only to boreal regions or to both hemispheres? Useful to make this clear. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
27961	26	45	26	45	Rather respectively snow and soil moisture as snow is an amplifying factor of winter warming in high latitudes, while soil moisture feedbacks amplify summer warming in mid latitudes. [Eric Brun, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
50323	26	45	26	45	suggested edit: 'associated with regional feedbacks' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
25911	26	45	26	46	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
130127	26	45	26	50	The authors might want to review differences between C.2.2 and the Chapter 9 Executive Summary regarding permafrost where the Chapter 9 authors clarify that the 4°C is above preindustrial levels. "Global +G235permafrost volume in the top 3 m will decrease by about 25 ± 5% per °C if global air temperature remains below 4°C above preindustrial levels. (medium confidence)" See Chapter 9 page 6. [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
27963	26	46	26	46	Is it regional and annual mean? Or seasonal? [Eric Brun, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
130129	26	46			Revise the end of the sentence to read "...scale linearly with global warming at a rate greater than the rise in GMST." [Trigg Talley, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130131	26	47	26	47	The statement in Chapter 5 that may be referenced for this statement says "The permafrost CO2 climate feedback is estimated to further reduce estimates of the remaining carbon budget by about 75 Gt CO2 (\pm 50 Gt CO2, 1 sigma range) per degree of additional warming, while the 49 CH4-lifetime feedback would result in an increase in remaining carbon budgets by about 35 Gt CO2 (\pm 8 Gt 50 CO2, 1 sigma range) per degree of additional warming." See page 85 of Chapter 5. Page 7 of Chapter 5 says "There is high confidence that thawing terrestrial permafrost will lead to carbon release, but the timing, magnitude and the relative roles of CO2 versus CH4 as feedback processes are known with low confidence. An ensemble of models project feedbacks due to CO2 release from permafrost of 20 ± 13 PgC per degree of global warming by 2100." [Trigg Talley, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
38953	27	1	27	2	It is not entirely clear what regions are meant here. If you mean ocean regions, I would suggest to rephrase: "Warming in some ocean regions that have historically warmed slowly or slightly cooled will eventually emerge and increase on centennial time-scale due to its slow response." However, I am not sure about the difference between "historically warmed slowly" and "eventually emerge ... due to its slow response". This reads as if the ocean continues to warm slowly? [Maike Nicolai, Germany]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
65607	27	1	27	2	Suggest changing the text for clarity to: "Warming in some regions that have historically warmed slowly or slightly cooled is likely to emerge and increase on centennial time-scales due to the slow response of the ocean." [Kushla Munro, Australia]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
27965	27	1	27	6	Though C3.2 conveys important findings for climate scientists, these findings are of little interest for policy-makers. We suggest to delete C3.2 for shortening the SPM. [Eric Brun, France]	Accepted. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
90203	27	1	27	6	Paragraph C3.2 seems too technical for us for an SPM and should be deleted and rather included in the TS. [Georges Gehl, Luxembourg]	Accepted. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
50325	27	1	27	6	Would it be possible to unpack in C3.2 what is meant by a 'slowly responding ocean', or quantify the timescale of the response for context? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50327	27	1	27	6	C3.2 does not seem to be consistent with statement B4.5, which states that stronger surface warming at the poles compared to low latitudes (i.e. polar amplification) is a robust feature of already observed climate changes in both hemispheres (i.e. including Antarctic). Would this not imply that Antarctic amplification has already been observed? If this isn't the case it would be helpful to explicitly state this is B4.5. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77061	27	1	27	28	Consider shortening these sections and providing information that is clear for policy. [Emer Griffin, Ireland]	Accepted. The topics of former section C3 are now covered much more succinctly in the revised SPM (mainly in. HS7.4, HS10.3).
77063	27	1	27	28	The timing and periods being referred to need to be much clearer, e.g. what is near term? [Emer Griffin, Ireland]	Taken into account. Near-, mid- and long- term are defined in table SPM.1 and HS7.4
130133	27	1			Revise beginning to read "Warming in some oceanic regions..." [Trigg Talley, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36205	27	1			C.3.2. suddenly brings up 'emerge' - the term is used earlier but also is not well defined. I believe that the typical reader will have their own view of 'emerge' in the sense of becoming 'obvious' to the naked eye and not statistically significant. Please check and be careful in using words that have common meanings for most people. [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
130135	27	2	27	2	Sentence seems incomplete by ending with "due to slowly responding ocean". What is the ocean slowly responding to? Global warming? CO2 emissions, specifically? [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
81855	27	2			Plurals needed: "timescales" and "oceans" [Dan Zwartz, New Zealand]	Not applicable, this bullet point was removed from the revised version.
38955	27	4	27	5	Please remind your resders what "Antarctic amplification" is. [Maike Nicolai, Germany]	Not applicable, this bullet point was removed from the revised version.
81429	27	5			Explain what Antarctic amplification is. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this bullet point was removed from the revised version.
23399	27	6	27	6	Is this low confidence due to scenario uncertainty? If so it would be nice to specify, in general it would be good to take the opportunity to remark when scenario uncertainty is the main factor, since there we have a motivation for mitigation (see my comment about how C.3 could better live up to the title of Section C). [Anna Amelia Sörensson, Argentina]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
8163	27	6	27	6	Suggest to spell out near-term=>near-term (2021-2040). [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
117233	27	6	27	6	section 7.4.4 is repeated twice [Maisa Rojas, Chile]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
38957	27	8	27	8	Not all your readers will know what "spatial warming contrasts" are. Could this be explained? [Maike Nicolai, Germany]	Taken into account. Sentence removed.
130137	27	8	27	9	First sentence is confusing as to the main claim, and the nature of causality that is alluded to. Suggest to revise as follows: "Widespread changes in large scale atmospheric circulation are projected, driven by atmospheric adjustments to radiative forcing and spatial contrasts in surface and tropospheric warming patterns." [Trigg Talley, United States of America]	Not applicable. Sentence removed from the revised SPM.
87187	27	8	27	9	It would be useful for the non-expert reader to explain what 'warming contrasts' mean here. [Oyvind Christophersen, Norway]	Not applicable. Sentence removed from the revised SPM.
81857	27	8	27	10	It is not clear what is meant by "Projected changes in spatial warming contrasts" Should "contrasts" be deleted? [Dan Zwartz, New Zealand]	Taken into account. Sentence removed.
9513	27	8	27	13	Phrasing needs work to be acessible to a policy maker. Lines 8-10 unclear. Suggest using the phrase 'storm tracks' instead of 'extra tropical jets' as no one outside of science understands what that means. [Joelle Joelle Gergis, Australia]	Taken into account. Storm track now mentioned in HS7.4 and bullet point significantly rewritten.
50329	27	8	27	13	It is not clear to a non-expert what is meant by 'spatial warming contrasts'. Please could you clarify or use simpler language to describe this such as: 'Projected contrast in spatial warming will be..' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed.
50331	27	8	27	13	It is not clear from C3.3 whether or not these changes in spatial warming contrasts would be attributed to global warming, given these happen 'in all emission scenarios', and that they are described to be 'not necessarily proportional' to global warming, and the references to different drivers. It would be helpful to clarify the attribution here if possible. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42663	27	8			changes in spatial warming contrasts' - does this mean 'detailed regional variations in warming'? If so, would be better to use simple wording. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Sentence removed.
67649	27	10	27	10	The NH monsoon circulations, or just the Asian monsoon? (this should be clear)0. And, what does "regional disparities" actually mean? [Karen Rosenlof, United States of America]	Not applicable: the part on monsoon circulation has been removed for conciseness.
25915	27	10	27	13	More information on monsoons could be provided on other regions according chapter 8, page 7, lines 7-10: "For the North American monsoon, projections indicate a decrease in precipitation, whereas increased monsoon rainfall is projected over South and Southeast Asia, East Asia and West Africa (medium confidence). For the South American monsoon, the CMIP6 projections do not indicate a clear increase in precipitation during the 21st century." [Don Alfonso Pino Maeso, Spain]	Taken into account: aspects of monsoon circulation have been removed for conciseness and information on monsoon onset and retreat over North and South America are now included
111483	27	10	27	13	Very long sentence, suggest breaking it into two. [James Renwick, New Zealand]	Not applicable: the part on monsoon circulation has been removed for conciseness.
130139	27	12	27	12	Re-word or re-phrase "but not necessarily proportional to global warming" to be more understandable to the public. Does this mean that poleward shifts of the extratropical jets will not match (i.e., linear relationship, etc) the levels of global warming? [Trigg Talley, United States of America]	accepted. 'not necessarily' does not appear in the revised SPM.
44821	27	12	27	13	"not necessarily proportional" is a complex way of expressing this. Please reword, or delete from "but not necessarily " to the end of the sentence. [Markku Rummukainen, Sweden]	accepted. 'not necessarily' does not appear in the revised SPM.
81859	27	13			There is no section 4.7.4 in the underlying report. What is the correct line of sight? [Dan Zwart, New Zealand]	Noted, thank you. All the lines of sight have been checked.
25921	27	15	27	15	It could be added to "interannual" the word "internal". [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111673	27	15	27	17	This sentence was hard to follow. How about turning it round? (very unlikely that... will decrease substantially) or (very likely that...will at least be maintained) [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
20971	27	15	27	20	Writing that ENSO and MJO will not decrease substantially is not very informative and not actionable. We suggest for the author to highlight or project the extent to which MJO and ENSO will decrease [Ladislav Chang, United Republic of Tanzania]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104203	27	15	27	21	As the first part of the statement is about circulation patterns not getting less intensive, followed by ENSO rain variability more intensive, can this statement also indicate what happens to all other circulation related changes? Some context of the importance of these changes would be helpful for policy makers. [Philippe Tulkens, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
76815	27	15	27	21	Much stronger statements could be made based on recent literature on the SAM and IOD, where palaeoclimate evidence, observations and models provide independent sources of evidence. [Nerilie Abram, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
27967	27	15	27	21	The main message of this section is not very clear. Section B.2.6 from the SROCC SPM, said that extreme ENSO events are expected to increase in frequency, and therefore intensify existing hazards, which is easier to understand. [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8161	27	15	27	21	As the first part of the statement is about circulation patterns not getting less intensive, followed by ENSO rain variability more intensive, can this statement also indicate what happens to all other circulation related changes? Some context of the importance of these changes would be helpful for policy makers. [Frank Dentener, Italy]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50333	27	15	27	28	Suggest here mentioning caveats on impacts being realised at finer local scales - it would be helpful to highlight to policy makers the value of national assessments for this finer scale. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. In the revised structure, we have added in the chapeau of the "Climate information for risk assessment and regional adaptation that "the generation of climate change information on global and regional scales assessed here aims at supporting decision-making, for instance as part of climate services" which include national assessment, among others. The intent/context of such a statement is clearer in the new structure in HS10.
25917	27	16	27	16	It would be useful to provide an explanation of the concept "annular modes" [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
84711	27	16	27	16	MJO is considered only in ch 8 and 10, while other tropical modes (i.e. Indian Ocean modes) are used more extensively within the report (to be used as example of behaviour) [Annalisa Cherchi, Italy]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
44823	27	17	27	17	"before 2100" sounds like this will occur after 2100. Is this implied? If not, suggest "during the 21st C" or some such expression. [Markku Rummukainen, Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
9515	27	17	27	21	Important to state where changes in ENSO rainfall variability will take place, list specific regions. [Joelle Joelle Gergis, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25919	27	17	27	21	To complete the information on ENSO, it could also be added from chapter 8, page 85, lines 43-46: "In summary, the primary implications for water cycle projections associated to tropical climate modes is the likelihood that ENSO's influence on precipitation will strengthen and shift eastward (medium confidence). Internal variability associated with most of the tropical modes results in considerable uncertainty in precipitation projections in regions influenced by their teleconnections (high confidence)". [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
130141	27	17			The statement "will not decrease substantially" implies that a signal of decrease is nonetheless expected. But that seems not true for all the listed modes of variability in the prior sentence. Suggest revision to read "...will not change substantially..." [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
42665	27	17			Is the word 'decrease' deliberately uses instead of 'no change'? i.e. Is it suggested that the magnitude (which I presume means amplitude) of these modes could increase? [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
65613	27	18	27	18	Suggest clarification, as there is variability in parts of the tropical Pacific. [Kushla Munro, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
32377	27	20			What is meant by "precipitation impacts"? Is it precipitation impacts on runoff or is it actual damage to people and infrastructure caused by precipitation? [Clemens Schwingshackl, Norway]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

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23401	27	23	27	23	10.4.2 could also be referred to here: see Ch10 ES Statement: "Based on multi-model historical simulations, regional-scale attribution studies and climate projections, in particular those coming from initial-condition large ensembles, it is very likely that internal variability will still significantly influence future multi-decadal precipitation trends in many land regions (except Antarctica, Section 9.4.2) until at least the mid-21st century {10.4.2}." [Anna Amelia Sörensson, Argentina]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
27969	27	23	27	24	This is also true for the long term. The point for the mid-term is that it offset the trend, and thus reduces the ability to detect the signal compared to the pre-industrial reference. The second part of the sentence should be rephrased. [Eric Brun, France]	Taken into account. The entire statement C3.5 has been rewritten with 3 new HS statements (H10) in the revised version. Those assess the role of internal variability at decadal scale, at near-term and for several physical parameters in a climate information for risk assessment and regional adaptation. The importance of Internal variability is also put into context with respect to human influence and therefore indirectly lead time for future projections.
65615	27	23	27	24	Suggest clarification since internal variability is expected to continue to exert an influence over the globe for the entire century. The statement currently given is about the size of natural variability compared with the anthropogenic signal, not the natural variability per se. Also suggest deletion of: "modes of". [Kushla Munro, Australia]	Taken into account. The entire statement C3.5 has been rewritten with 3 new HS statements (H10) in the revised version. Those assess the role of internal variability at decadal scale, at near-term and for several physical parameters in a climate information for risk assessment and regional adaptation. The importance of Internal variability is also put into context with respect to human influence and therefore indirectly lead time for future projections. As suggested "Modes of" has been removed for simplicity.
80139	27	23	27	28	Internal variability is naturally higher at regional scales but it is not higher in the near-term. The statement is not true, it is just proportionally higher compared to other sources of uncertainties. Actually it is not constant with lead time: with a warming climate it is getting larger for precipitation and lower for temperature (regardless of being a near-term). The statement though in the last sentence is true, but we should emphasize here that near-terms are predictions and not projections and we should not confuse it with the scope of this report. [Lilian Fejes, Hungary]	Noted. In the revised structure, effects of internal variability are addressed within the "climate information for risk assessment and regional adaptation" section to insist on considering all the possible outcomes for planning and adaptation. The importance of Internal variability is also put into context with respect to human influence and therefore indirectly lead time for future projections. The last sentence referring to decadal climate prediction has been removed for simplicity.
130143	27	23			Revise first sentence to read "...substantial influence on fluctuations in climate..." [Trigg Talley, United States of America]	Not applicable. The entire statement C3.5 has been rewritten with 3 new HS statements (HS10) in the revised version.
36207	27	23			maybe: 'on THE EARTH's climate' [Michael PRATHER, United States of America]	Not applicable. The entire statement C3.5 has been rewritten with 3 new HS statements (HS10) in the revised version.
29421	27	24	27	24	further specification needed for 'near term' and 'regional scale' [Joachim Fallmann, Germany]	Noted. In the revised version, a dedicated HS is devoted to near-term (HS10) and it is now clearly stated. Near term is also defined in the Table SPM.1 in section B.
42257	27	24	27	25	C3.5 L24-25: "Modes of variability" is technical and difficult to understand (even though examples are given in C3.4) [Tina Christensen, Denmark]	Accepted. "Modes of variability" has been removed

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9517	27	24	27	26	What does 'drive departures from the human caused large scale circulation reponse' actually mean? You need to state what you mean more clearly e.g. interact with? [Joelle Joelle Gergis, Australia]	Noted. A dedicated HS (HS10) is now providing in the revised version of the SPM on the assessment of the modulation of the human-caused changes by natural variability. Words leading to confusion such as "interact", "drives departures" have been carefully scrutinized and replaced.
65609	27	26	27	26	Suggest rephrasing to use the term "dampen" instead of "mitigate", since "mitigate" in this context implies a deliberate policy intervention. [Kushla Munro, Australia]	Taken into account. A new HS statement (HS10.3) is provided and the expression "exacerbate or mitigate" has been replaced by "intensify or obscure" in line with Chap1 phrasing.
69399	27	26	27	28	The implications of "initialized climate prediction" are not readily understandable for the policy makers. This should be clearly explained further in the Glossary as appropriate. [Kaoru Magosaki, Japan]	Not applicable. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
44825	27	26	27	28	Suggest deletion of last sentence in C3.5. It is a finding about methodology, not about climate change... The reason for the sentence here is not evident. [Markku Rummukainen, Sweden]	Taken into account. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
130145	27	26	27	28	"initialized climate predictions" needs clarification. Initialized with what? Many policymakers will not understand the distinction here from CMIP5/6 projections. [Trigg Talley, United States of America]	Taken into account. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
81861	27	26			irrespective [not "irrespectively"] [Dan Zwart, New Zealand]	Not applicable. Sentence changed.
25923	27	27	27	27	It would be useful to have an explanation of the concept "initialized climate projections". [Don Alfonso Pino Maeso, Spain]	Not applicable. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
27971	27	27	27	27	We suggest to reformulate the sentence in order to clarify what are "initialized climate predictions". Policymakers are not familiar with this term. [Eric Brun, France]	Not applicable. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
41327	27	27	27	27	The average SPM reader will have no idea what an "initialised climate prediction" is... Please reformulate. [Alexander Nauels, Germany]	Taken into account. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
130147	27	27	27	28	The window of "near term" needs to be stated. This section is about climate predictions of variability, rather than of projections for change, therefore suggest to change the sentence to read " ...to reduce the uncertainty in near-term [years to decade] regional temperature variations... " [Trigg Talley, United States of America]	Noted. In the revised version, a dedicated HS is devoted to near-term (HS10) and it is now clearly stated

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36209	27	27			initialized climate predictions' -- this is not adequately explained, can we initialize the ocean state? how long can we do the prediction regardless? From Chapter 11 AR5, there was limited or no skill beyond 2 years here except for GHG-forced climate changes. [Michael PRATHER, United States of America]	Not applicable. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
32379	27	27			Maybe "initialized climate predictions" could be shortly explained. [Clemens Schwingshackl, Norway]	Not applicable. The assessment from "initialized climate projections" referring to "decadal forecast" is not included anymore in the final version of SPM. Headline statements are now much simpler and shorter to provide a high level summary of the SPM
42413	27	31	27	42	The figure is cramped and difficult to read. [Tina Christensen, Denmark]	Taken into account. Panels, captions and intents have been substantially revised.
65611	27	31	27	44	Suggest including greater explanation and modification for this Figure for greater understanding: 1) In the caption, indicate year of the respective temperature threshold crossings, to connect to Box SPM 2 Table 1. 2) Indicate SSP used to construct the maps. 3) consider using similar colour scales for precipitation anomaly and for consecutive dry days to visually indicate "wetter" versus "drier" 4) Non-scientific readers may wonder why the annual exceedance map does not show the ocean. Suggest explaining this in the caption [Kushla Munro, Australia]	Taken into account. Panels, captions and intents have been substantially revised.
11619	27	31	27	44	Figure SPM.8 is misplaced here, should be placed near section C.5 [Gerhard Krinner, France]	Taken into account. Figure is now moved.
29423	27	31	27	44	Figure SPM.8: unclear what number at top right of each figure stands for, further more information with respect to CCD. How many CCDs does the realtive anomaly corresponds to? [Joachim Fallmann, Germany]	Not applicable. Number of models is no longer shown in final figure.
42259	27	31			Figure SPM8: Headline second row: use "daytime temperature of annual warmest day" instead as written in the figure caption [Tina Christensen, Denmark]	Not applicable. Panels have been removed.
28127	27	31			Regarding Figure SPM.8: - What the figures on the upper right corner of each planisphere correspond to ? This must be explained in legend. - Please add uncertainties, as Figure TS.19. [Eric Brun, France]	Not applicable. Number of models is no longer shown in final figure.
130149	27	33	27	33	Not sure this section needs " The purpose of this figure" [Trigg Talley, United States of America]	Taken into account. Intent has been substantially revised.
90785	27	33	27	35	Will this italicized text be included in the caption of Fig. SPM.6? What is of interest is whether these individual events across the globe show a trend consistent with anthropogenic climate change. Indeed, this is what Table SPM.1 does. [José Romero, Switzerland]	Not applicable. There is no longer italic text.
108559	27	37	27	38	These images are unclear, what do they mean? What are you going for here? [Jason Donev, Canada]	Taken into account. Intent has been substantially revised.
19547	27	37	27	42	In figure SPM.8, the meaning of numbers printed near the top r.h.s. of each subplot is not indicated. [philippe waldteufel, France]	Not applicable. Number of models is no longer shown in final figure.
32381	27	37	27	42	The information about bias adjustment could also be put at the end of the caption, e.g. by adding "Annual TX exceedance over 35°C is derived from bias-adjusted data (using quantile delta mapping)." [Clemens Schwingshackl, Norway]	Not applicable. Panels are not shown in revised figure.
32383	27	37	27	42	There is a double mention of the fact that the figure shows changes relative to 1850-1900. [Clemens Schwingshackl, Norway]	Taken into account. Panels, captions and intents have been substantially revised.

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44079	27	37			Please consider adding panels for SSP2-45/3degC warming as this would aid the provision highly policy relevant information (estimated 2100 warming from NDCs presented in SR1.5). [Lamin Mai Touray, Gambia]	Rejected. This information is available in Atlas and chapter but space in SPM is limited
41329	27	37			Please add caption information on the number in the top right corner of each panel, probably number of model runs. [Alexander Nauels, Germany]	Not applicable. Number of models is no longer shown in final figure.
99991	27	37			We acknowledge the work of the authors and recommend that figure SPM.8 would offer an excellent opportunity to show changes for an NDC-like 2100 pathway. SSP2-45 would provide a similar 21st century temperature trajectory to an NDC like pathway (as presented in SR1.5). Please include an additional column with panels for SSP2-45. In general, it may be useful to reflect in which context SSP5-85 high end projections should be shown, and where the much more policy relevant NDC pathway information may be more suitable. [Caroline Eugene, Saint Lucia]	Not applicable. Changes are shown for GWLs and not SSPs.
68813	27	37			SPM8 provides an excellent opportunity to show changes for a NDC-like 2100 pathway. SSP2-45 would provide a similar 21st century temperature trajectory to an NDC like pathway (as presented in SR1.5). Please include an additional column with panels for SSP2-45. In general, it may be useful to reflect in which context SSP5-85 high end projections should be shown, and where the much more policy relevant NDC pathway information may be more suitable [Jeffers Cheryl , Saint Kitts and Nevis]	Not applicable. Changes are shown for GWLs and not SSPs.
97349	27	38	27	40	A short explanation why bias-adjustment for TX was necessary could be helpful since TX is the only parameter that was adjusted here. [Nicole Wilke, Germany]	Not applicable. Panels are not shown in revised figure.
97351	27	39	27	39	If the method of bias-adjustment is mentioned (quantile delta mapping) one would expect the target observation data set for the adjustment to be mentioned, too. Please amend. [Nicole Wilke, Germany]	Not applicable. Panels are not shown in revised figure.
37649	27	42	27	42	Full detail of how this Fig is prepared is not available here nor in TS. It may be better to make it traceable to original Ch. [Masahide Kimoto, Japan]	Line of sight has been revised
97353	28	0			Please explain "atmospheric evaporative demand" [Nicole Wilke, Germany]	Taken into account. Term removed from section on climate future.
65619	28	1	28	3	Suggest removing the confidence summary for C.4 since this is a statement of fact about growth in evidence. Suggest rephrasing 3. so that the likelihood statement applies to the projection, not the growth in evidence, e.g.: Evidence that future water cycle changes will include large regional changes in seasonality, variability and extremes has grown since AR5. There is now high confidence in this projection. [Kushla Munro, Australia]	Accepted. As a general rule, we have significantly reduced the length the headline statement (text in blue) and we are trying to keep the language as simple as possible, which includes avoiding IPCC uncertainty language. In this specific case, HS7 is only 1 sentence long and has no confidence statement.
12679	28	1	28	50	Ocean is missing again. 97% of Earth's water is in the ocean, so ocean both regulates water cycle and records its changes. So it is important to stress the ocean's role here. [Lijing Cheng, China]	Noted. Water cycle information have been re-distributed in the FGD highlighting the information with higher policy makers relevance
20973	28	1	28	52	Issues of drought have not been adequately covered under this section. We suggest themajor drought challenges facing most of the country in Africa be appropriately and adequately covered and characterized. [Ladislaus Chang'a, United Republic of Tanzania]	Taken into account. Drought are now covered in figures SPM.5, SPM.6, SPM.9 as well as in HS3, HS6 and HS11

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39951	28	1	29	5	As in Section B, in section C (future changes) over the "land" findings are present in C.4 but not very visible.(Bravo for section C2 highlighting work since SROCC) It seems that most of C4 deal with changes of the water cycle over land. Maybe this would be the place to highlight this? Perhaps, C.4 Future changes of the water cycle -> C.4 Future changes of the water cycle, particularly over the land, or C4: Future changes: land and the water cycle [TSU WGI, France]	Not applicable. Headline statements of the revised SPM no longer have headings.
130151	28	1	29	5	No mention of issues of water managment and biofuels, water management practices, or salinity issues. [Trigg Talley, United States of America]	Rejected. This is beyond the mandate of working group I.
105599	28	1	29	5	Discussing water cycle changes in C.4 is very difficult due to different sign changes in different regions. However, I am sure that the policy makers will want to know more than changes are expected in "some regions". I wonder if the authors could at least include some example when they say "some regions"? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Fig SPM.5 shows this information for all the IPCC regions.
38959	28	1	30	29	It is not clear to me why precipitation is party addressed in C4 (water cylce) and C5 (extremes). Many of the processes described in C4 seem to become extremes (wet extremes are even mentioned on page 28 line 5) - so why is there a differentiation? For example, is an increase in monsoon rainfall (page 28, line 26) not considered an extreme? Do these sections need restructuring or a shift of focus? [Maike Nicolai, Germany]	Accepted. Extremes related to the water cycle are now addressed together in HS7.2, in the same subsection as the rest of the water cycle (HS7).
39543	28	1	38	18	Nearly all the projections are qualitative, not quantitative. The exceptions are C.5.3 and C.4.1, 1-3 % per °C which is very small and uncertain by a factor of 3. Orders of magnitude are even not given for other items, only the confidence. This is very poorly informative. [François Gervais, France]	Noted. Quantities have been added wherever possible.
78641	28	1			Can you merge C3 and C4. A non-technical audience won't know the distinction between, for example, ENSO going into C3 and Monsoons going into C4. I appreciate they're mechanistically different – but that a technical distinction for scientists – for SPM they sit better together [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. C3 has no equivalent in the revised SPM. Instead, the important information has been integrated in other subsections (e.g. some parts of C3.3 on extratropical jets have been moved to HS7.4)
5295	28	3	28	4	I suggest deleting the first sentence. It is very generic. The next few sentences are much more specific. [Daniel Murphy, United States of America]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.
50335	28	3	28	13	Suggest that "Water cycle variability over land" is changed to "Changes to water cycle variability over land" for clarity. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Headline statements/subsections do not have titles anymore.
86983	28	3	28	13	We believe that sentence two, three and four in this highlighted conclusion is to a certain degree dealing with the same issues and should be streamlined and shortened. Please consider to shorten this highlighted conclusion. In addition, water cycle related extremes (like in the second sentence) are also delt with under the next highlighted conclusion (C.5 page 29). [Oyvind Christophersen, Norway]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined. Note that HS7.2 now deals with water cycle extremes.
130153	28	3	29	5	Changing precipitation patterns, combined with increased air temperatures, threaten freshwater sources, resulting in the potential for conflict over water, regional instability, and U.S. assistance. [Trigg Talley, United States of America]	Noted.

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50337	28	3	29	5	Throughout C4 and its subsections, there is little information on how these changes vary across emission scenarios. While C4.1 mentions that most water cycle changes are not linear compared to temperature, it would still helpful to get a qualitative idea of these projected changes are affected by emission scenarios where possible. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Emission scenarios are considered with more details in presenting future changes in precipitation and other water cycle aspects
36211	28	3			This is also one of those endless headline statements. You really need to cut these down to 1 or 2 sentences (short ones) that give the tenor of the section without squeezing in all the factoids. [by the way, I am glad you did not just say CO2 here!] [Michael PRATHER, United States of America]	Accepted. The revised headline statements have been streamlined and shortened.
36213	28	3			Let me try for a true pink headline: Since the AR5, growing evidence indicates that the future water cycle will be notable perturbed by increasing greenhouse gas concentrations. There is medium to high confidence that regional changes in precipitation, wet and dry extremes will be pervasive. [needs some work by the LAs, but it is about the right length for a headline. [Michael PRATHER, United States of America]	Noted. The new HS7 has been completely rewritten.
101589	28	4			Change "seasonality, variability and extremes" to "seasonality, variability, and extremes" [Knut Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
37651	28	6	28	6	I wonder if the expression, "increasing evaporative demand", can be readily understood by SPM readers. [Masahide Kimoto, Japan]	Taken into account. Evaporative demand no longer features in the subsection on the future of the water cycle (HS7)
130155	28	6	28	7	The meaning of this sentence is unclear. It speaks of increasing "evaporative demand". Do authors mean to say "increasing evaporation"? Assume authors are alluding to the "potential to evaporate", the latter of which readers also assume an increase because of warming. But none of this is made clear. The sentence also asserts that this increasing demand will lead to "further drying". Do authors mean "further" than some historical drying that had already been observed? Do authors instead mean "further" than would have been the case in the absence of warming? And then the sentence goes on to claim this increasing evaporative demand will occur in "some regions" -- to which the reader would naturally ask: which ones? And, then to muddle matters a bit further, as a further condition of where or when this effect might arise, readers are told "under higher global warming". Higher than what threshold of warming, or emissions, or time in the future? Isn't increased evaporative demand expected to occur for almost any and all amounts of warming? These matters need clarification. [Trigg Talley, United States of America]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.
130157	28	6	28	7	One of the most serious consequences of higher temperatures will be increased evaporative demand, resulting in increased soil drying, especially in semiarid regions where dryland farming practices may leave the soil bare for extended fallow periods. Since this has major implications for agricultural production and food security, it should be drawn to policymakers' attention in the section summary. Thus, the third sentence in the section summary might be modified to read: "There is high confidence that increasing atmospheric evaporative demand will lead to further SOIL drying tendencies in some LOW-RAINFALL regions under higher global warming." [Trigg Talley, United States of America]	Noted. This is considered in final SPM combining information related to A3.2, B3 and figures SPM.3 and SPM.5
86985	28	6	28	7	Please consider using easier to understand language. Especially "increasing atmospheric evaporative demand" is too far away from plain language for policymakers. [Oyvind Christophersen, Norway]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17503	28	6	28	8	Atmospheric evaporative demand' - could this simply read: 'evaporation' or can it be simplified in some other way? How does this differ from 'evapotranspiration'? Does this need to be explained? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Evaporative demand no longer features in the subsection on the future of the water cycle (HS7)
42261	28	6			C4 headline statement, L6: "atmospheric evaporative demand" and "evapotranspiration" are very technical terms [Tina Christensen, Denmark]	Taken into account. The terms no longer features in the subsection on the future of the water cycle (HS7)
36215	28	6			Please, 'atmospheric evaporative demand' is not a headline discussion, plus it seems a little too technical for SPM. [Michael PRATHER, United States of America]	Taken into account. Evaporative demand no longer features in the subsection on the future of the water cycle (HS7)
44827	28	7	28	7	What is the meaning of "higher"? Higher than what? (If the dimension is one of time, then "continued warming" or suchlike would be a better term.) [Markku Rummukainen , Sweden]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.
9519	28	7	28	9	Unclear what is meant by 'water cycle changes will mostly manifest as enhanced spatial and seasonal contrasts between dry and wet regimes'? Does this mean more pronounced seasonal variability between wet and dry areas? [Joelle Joelle Gergis, Australia]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.
44829	28	8	28	9	The "... but water cycle changes... regimes" is a very complicated expression. If the idea is to refer to a range of regional changes, please reword as appropriate. [Markku Rummukainen , Sweden]	Taken into account. The headline statement (now HS7) has been completely rewritten, shortened and streamlined.
34419	28	8			Projections of GSAT appear to be higher for 3 pathways comparable to the AR5 RCPs. For example, Table 1 has T rise (above that in 1850-1900) in the last 20 years of this century is about 0.3C higher than that of the AR5 RCPs 2.6, 4.5, and 8.5. This seems like a notable finding that would be important to explain why these comparable scenarios have warmer outcomes. [Haroon Kheshgi, United States of America]	Noted. the SSP scenarios used in AR6 are not identical to the corresponding RCPs used in AR5. There is a difference in the mix of radiative forcings. The differences are assessed in Chapter 4 Fig.4.35 and related text. However, due to space constraints this cannot be included in the SPM.
130159	28	10	28	11	There is an inconsistency between the statement "These changes are increasingly dominated by the response to increased greenhouse gas concentrations, although other anthropogenic and natural forcings can alter near-term responses" and C.4.5, lines 49-50. There it is written that "decadal to multidecadal internal variability strongly affects near-term water cycle responses". The conventional usage is that "natural forcings" refers to solar and volcanic effects, and are to be distinguished from internal (unforced) variability. [Trigg Talley, United States of America]	Not applicable. The headline statement (now HS7) has been completely rewritten, shortened and streamlined. The part no longer appears in the statement.
80141	28	10	28	12	Instead of the response to concentrations it would be better to use emission scenario uncertainty. Furthermore, models actually have higher ratio in the uncertainty of the results. Also, natural variability is not high particularly in the near-term. Especially for precipitation, on seasonal and regional levels it stays high, and only proportionally gets lower. Please rephrase it. [Lilian Fejes, Hungary]	Not applicable. The headline statement (now HS7) has been completely rewritten, shortened and streamlined. The part no longer appears in the statement.
27973	28	11	28	11	Please develop the finding "although other anthropogenic and natural forcings" in the following paragraphs [Eric Brun, France]	Not applicable. The headline statement (now HS7) has been completely rewritten, shortened and streamlined. The part no longer appears in the statement.
44831	28	16	28	16	The reference to paleoclimate studies would seem unnecessary here, and could be removed. [Markku Rummukainen , Sweden]	Accepted. The text no longer refers to paleoclimate.
27975	28	16	28	16	The 1st sentence of C4.1 conveys important findings for climate scientists. However and in order to shorten the SPM, we suggest to delete the 1st sentence since these findings are of little interest for policy-makers. Moreover, this sentence is rather vague. [Eric Brun, France]	Accepted. The text no longer refers to paleoclimate.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77065	28	16	28	17	see earlier comments on narrative and terms used for the "energy budget" [Emer Griffin, Ireland]	Noted.
130161	28	16	28	17	This sentence stating paleoclimate studies show water cycle responses to past changes in the Earth's energy budget is ambiguous, if not overly broad, and thus of marginal value to policymakers if not uninformative. At glacial-interglacial timescales and longer, paleoclimate studies can be interpreted to infer global water cycle responses to changes to the Earth's energy budget. At the timescale of the Holocene, paleoclimate studies reveal regional to subcontinental water cycle responses to changes to the Earth's energy budget, over the last 1000 years, paleoclimate studies reveal regional to local water cycle responses but a causality role for changes in the Earth's energy budget is not readily discerned. Need to bound the sentence in terms of timescale and spatial scale to be informative to policymakers. [Trigg Talley, United States of America]	Taken into account. The text no longer refers to paleoclimate.
41331	28	16	28	17	Is this first sentence needed given the fact that this subsection is dealing with future changes? Paleoclimate understanding is somewhat captured with "process understanding" in the following sentence. [Alexander Nauels, Germany]	Accepted. The text no longer refers to paleoclimate.
5297	28	16	28	23	I suggest moving this down. As with other sections, if somebody only reads one or two of the C.4 bullets, which one do you want them to read? Put them first. [Daniel Murphy, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54683	28	18	26	19	It is of questionable relevance to only give policy-makers results for changes in mean precipitation over land under the highest emission scenario (SSP5-8.5). Highly preferable to have a general statement about changes in mean precipitation per degrees C global warming. Possible alternate text could be that from lines 17-20 in Ch. 8 ExSumm. [Nancy Hamzawi, Canada]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
7699	28	18	28	19	Lack of clarity. The following wording is suggested: Over land, mean precipitation will likely increase by 1-3% per 1°C global warming for the SSP5-8.5 scenario. [Klaus Radunsky, Austria]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25925	28	18	28	19	We suggest using in this respect the following sentence from chapter 8, page 5, lines 27-28, which also covers precipitation over ocean: "It is very likely that precipitation response to CO2-induced warming over the global land (1.6±0.7 %/°C) is smaller in magnitude but with a larger range than for the global ocean (2.8±0.2 %/°C)." [Don Alfonso Pino Maeso, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
35277	28	18	28	19	Using only the 8.5 scenario makes it look like you are trying to tell a story (and brings on outside criticism). You should also use one of the midrange and one of the low (high-mitigation) scenarios in a discussion about a variable of such magnitude (precipitation). [patrick Michaels, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41819	28	18	28	20	I would disagree with the role of CO ₂ on WUE. This is simplifying the process very much. In humid regions CO ₂ would increase WUE, but this is irrelevant to assess drought/aridity. On the contrary, in dry regions and drought periods, the role of CO ₂ on WUE is expected to be negligible (experimental studies support this issue) so the water saving in the regions in which the CO ₂ effects could remediate drought/aridity will be probably irrelevant. In addition, in a more humid and warmer global scenario it is expected that vegetation cycles are longer and LAI would increase, counteracting the role of the CO ₂ on water saving. See e.g. Brodribb, T. J., Powers, J., Cochard, H., & Choat, B. (2020). Hanging by a thread? Forests and drought. <i>Science</i> , 368(6488), 261–266. https://doi.org/10.1126/science.aat7631 , Vicente-Serrano, S. M., McVicar, T. R., Miralles, D. G., Yang, Y., & Tomas-Burguera, M. (2020). Unraveling the influence of atmospheric evaporative demand on drought and its response to climate change. <i>Wiley Interdisciplinary Reviews: Climate Change</i> , 11(2). https://doi.org/10.1002/wcc.632 , Allen, C. D., Breshears, D. D., & McDowell, N. G. (2015). On underestimation of global vulnerability to tree mortality and forest die-off from hotter drought in the Anthropocene. <i>Ecosphere</i> , 6(8). https://doi.org/10.1890/ES15-00203.1 [Sergio Vicente-Serrano, Spain]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
44833	28	19	28	19	Please refer to the range of scenarios. [Markku Rummukainen, Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
18731	28	19	28	19	Shouldn't this 1-3% per K increase in precipitation over land be independent of the scenario? [Govindasamy Bala, India]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
97355	28	19	28	19	"Precipitation will likely increase by 1-3% per °C for the SSP5-8.5 scenario." 1. Reads like there will be a different increase per °C for other scenarios!?. 2. The increase of evaporation is missing here. A reader could understand that rising temperatures would help to combat desertification/drought because of increasing precipitation. Please check/rephrase or delete. [Nicole Wilke, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
40523	28	19	28	19	Maybe quote one other scenario/RCP, as to not put the spotlight only on SPM5-RCP8.5. [TSU WGI, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
40525	28	19	28	19	Maybe quote one other scenario/RCP, as to not put the spotlight only on SPM5-RCP8.5. This comes up again on page 35 line 6 [TSU WGI, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
86135	28	19	28	19	Is citing mean global change in precipitation at all informative, given that “contrasts between dry and wet regimes” will increase? 3% overall change means little if wet regions get wetter and dry regions get drier. If the global implication of this is a general increase in cloudiness, then this could be called out. But a global average approach is especially unhelpful for all regions which will see reductions in rainfall, notably most of Africa which is already largely a dry continent, also Australia. Suggest that water cycle bullets are handled with these practicalities in mind. You can protect yourself against too much rain to a large extent, but you can do little if there is not enough. The increasing runoff is also important in regions that depend on water reservoirs. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130163	28	19	28	21	Suggest rather than saying "Most water cycle changes..." without enumeration, to be specific and state "Global mean precipitation and evaporation will increase in magnitude with global warming, although their scaling is generally less than the rate of global temperature rise...". Suggest to add the statement, since it's a key water cycle element and contrasts with the mean precipitation change: "Global and many regional extremes in daily precipitation will increase in magnitude at a scaling closer to that of the global temperature rise and the associated rate of increase in atmospheric moisture content." [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
130165	28	19	28	23	The scaling of water cycle changes to changes in global warming needs to be described in clearer terms. Specifically, define what is meant by "due to the larger relative influence of atmospheric adjustment to radiative forcings". It would seem that there are a lot of factors that would cause water cycle changes not to scale linearly with global warming. [Trigg Talley, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
97357	28	19			Why using only the SSP5-8.5 scenario? [Nicole Wilke, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36217	28	20			This sentence is too difficult for SPM, maybe too much information? [Michael PRATHER, United States of America]	Accepted. Part removed from the revised SPM.
44835	28	21	28	22	The "due to... pathways" is unclear and could be deleted without losing information about the projected changes as such. [Markku Rummukainen, Sweden]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50339	28	21	28	22	atmospheric adjustment' - it would be helpful to briefly explain what you mean by this - does this refer to weather pattern and atmospheric circulation changes? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
80143	28	22	28	22	Emissions choice is mentioned here but model uncertainty and natural variability is larger. [Lilian Fejes, Hungary]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77577	28	25	28	25	I may be incorrect but I think the general reader is likely to always associate the term "monsoon" with the Indian monsoon. Perhaps some clarity is required here to distinguish regional monsoons? [Emer Griffin, Ireland]	Taken into account. Regional monsoons have been specifically defined. Assessment in the SPM is reported either for the global monsoon and for the regional monsoons, with specific identifications
65617	28	25	28	25	Suggest changing the text to "Future changes in monsoon rainfall are likely [or "are projected"] to exhibit regional variability [or "heterogeneity"] " since we don't know what will happen. [Kushla Munro, Australia]	Taken into account. Changes in regional monsoons are specified wherever relevant
117235	28	25	28	30	this paragraph is confusing. Slowdown of monsoon circulation has nothing to do with monsoon precipitation? In para C.3.3 it is said that NH monsoon circulation will decrease, and here that precip will increase. [Maisa Rojas, Chile]	Noted. Information about changes in regional monsoons has been simplified with reference to the changes in precipitation alone (in the SPM)
97359	28	25	28	36	The paragraphs C4.2 and C4.3 address several aspects, but only one overall uncertainty statement (high confidence) is provided. Please clarify if the uncertainty statement does refer to all aspects. [Nicole Wilke, Germany]	Noted. Information has been re-organized and uncertainty statements are provided wherever appropriate
130167	28	25			"exhibit regional contrasts" is an odd phrasing for the future changes in monsoon rainfall and suggest replacing with "vary regionally" since the following sentence indicates monsoon rainfall will increase globally although more strongly in the NH with no contrast of decreasing. [Trigg Talley, United States of America]	Taken into account. Specific regional monsoons are specified in the revised text

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36219	28	25			Again, too much confusing info for SPM. What does it mean to the govts that the 'circulation' slows down but 'rainfall' increases. The latter is all they care about. [Michael PRATHER, United States of America]	Noted. Information about changes in regional monsoons has been simplified with reference to the changes in precipitation alone (in the SPM)
67675	28	27	28	27	Is this in all NH monsoons (NH and Asian?) [Karen Rosenlof, United States of America]	Noted. Text has been re-organized. One sentence is for global monsoon and another sentence for regional monsoons
80145	28	27	28	30	The "Global land" sentence is in medias res here and replaced in the next sentence. Also, the next sentence is generalizing mostly and not mentioning the regional patterns. [Lilian Fejes, Hungary]	Noted. Global land monsoon precipitation is separated in the revised text from regional monsoon changes. One statement is for global and a separated sentence for regional
44837	28	28	28	30	The point made with the last sentence of C4.2 is not evident. Would there be a clearer way of expressing that there will be regional differences? [Markku Rummukainen, Sweden]	Taken into account. The last sentence has been removed from the revised bullet point (HS7.3)
130169	28	28	28	30	The sentence beginning "Regional and seasonal mean precipitation changes..." offers merely a list of all plausible factors that can drive precipitation change, and is thus of little value to inform policymakers. It offers neither synthesis on how particular factors may be more important nor the regions (e.g., tropics, subtropics, midlatitude, high latitudes) where some of these factors are understood to be more important than others. [Trigg Talley, United States of America]	Taken into account. The last sentence has been removed from the revised bullet point (HS7.3)
36221	28	29			This is important (regional land surface forcings) but many times earlier it just says GHGases. Get a consistent message about the water cycle and non-GHG controls. [Michael PRATHER, United States of America]	Noted. Diversification of GHG and non-GHG for precipitation and other water cycle properties has been clearly included in the revised SPM
41821	28	30	28	31	Drying will be stronger in humid regions. In water limited areas there is few water to evaporate. What will affect warming and increase in the atmospheric evaporative demand is the vegetation stress in water-limited regions. [Sergio Vicente-Serrano, Spain]	Noted. The text has been highly re-worked and these details have been taken into account in final (approved) B3 and C3, as well as in Fig. SPM.3 and SPM.5. More intense dry seasons and events encapsulate multiple aspects including higher evaporative demand
130171	28	32	28	33	The sentence "Global, annual and daily precipitation over land are projected to increase, causing an overall increase in runoff..." seems a bit at odds with the claim in C.4, lines 6-7, that increasing evaporative demand will lead to further drying. Here one reads only of the precipitation changes causing more runoff. What happened to the brake on runoff production caused by the atmospheric demand? This point needs clarification. [Trigg Talley, United States of America]	Noted. The text has been highly re-worked. Details of changes in extremes and other water cycle properties are better organized within final (approved) B3, C3, Fig SPM.3 and Fig SPM.5
130173	28	33	28	33	Does the overall increase in runoff refer to naturalized runoff/naturalized streamflow? The human use component is important to include in how the "increase" will be affected. In addition to regional and season-dependence, there are socio-economic factors. [Trigg Talley, United States of America]	Not applicable. That part of the text has been removed
130175	28	34	28	51	[CONFIDENCE] The statement that precipitation will increase and thus an overall increase in runoff will occur seems like an oversimplification particularly when high confidence is assigned to this trend. Do we truly have medium to high confidence in the link between increased precipitation and runoff on a global scale such that we can be making overall statements about projected trends in runoff? It would seem that trends in precipitation and runoff should be assessed separately and assigned separate levels of confidence. [Trigg Talley, United States of America]	Not applicable. That part of the text has been removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104205	28	38	28	39	"There is high confidence that increasing atmospheric evaporative demand will lead to further drying tendencies in some regions under higher global warming". Please mention which are those regions (or some of them). This is important for policy-makers (especially those of these most affected regions). [Philippe Tulkens, Belgium]	Noted. For space and consistency no regions are specified in the SPM but this information can be found in the TS and chapters 8 and 11.
130177	28	38	28	39	This sentence is identical to that of lines 6-7 and requires repair. It speaks of increasing "evaporative demand". Do authors mean to say "increasing evaporation"? Assume authors are alluding to the "potential to evaporate", the latter of which readers also assume an increase because of warming. But none of this is made clear. The sentence also asserts that this increasing demand will lead to "further drying". Do authors mean "further" than some historical drying that had already been observed? Do authors instead mean "further" than would have been the case in the absence of warming? And then the sentence goes on to claim this increasing evaporative demand will occur in "some regions" -- to which the reader would naturally ask: which ones? And, then to muddle matters a bit further, as a further condition of where or when this effect might arise, readers are told "under higher global warming". Higher than what threshold of warming, or emissions, or time in the future? Isn't increased evaporative demand expected to occur for almost any and all amounts of warming? These matters need clarification. [Trigg Talley, United States of America]	Not applicable. This part has been thoroughly revised and only a description of the different types of drought remains in the final (approved) SPM (footnote 15). The reader is referred to the underlying chapters and the TS for the process description. A3.2 now reads:"... Human-induced climate change has contributed to increases in agricultural and ecological droughts in some regions due to increased land evapotranspiration (medium confidence)."
80147	28	38	28	41	There is a possibility that there is a logical order issue in the first two sentences. Also, the 2nd is repeating partly the 1st sentence. [Lilian Fejes, Hungary]	Not applicable. The text has been completely rewritten for the final version.
93767	28	38	28	43	Aren't the processes described in the second sentence (driven by increased land surface temperatures) also contributing to the expansion of arid areas towards mid-latitudes mentioned in the third sentence? The current formulation can suggest that this contribution is not existing. [Quentin Lejeune, Germany]	Noted. The description now reads: "Agricultural and ecological drought (depending on the affected biome): a period with abnormal soil moisture deficit, which results from combined shortage of precipitation and excess evapotranspiration, and during the growing season impinges on crop production or ecosystem function in general (see Annex VII: Glossary). Observed changes in meteorological droughts (precipitation deficits) and hydrological droughts (streamflow deficits) are distinct from those in agricultural and ecological droughts and are addressed in the underlying AR6 material (Chapter 11)." footnote 15, in the final (approved) version
86987	28	38	28	43	We miss mention of soil quality/structure as a climatic impact driver. Soil moisture/dryness is not only a question of the ratio of precipitation and heat (i.e. potential evaporation), but also a question of the ability of soils/plants/landscapes to retain and exchange water. If water holding and exchange is better, the effects of precipitation deficit or surpluses will be attenuated, and water availability for (near surface) evaporative cooling will improve and attenuate heat extremes. If these issues are dealt with in WGII, please coordinate across WGs. [Oyvind Christophersen, Norway]	Accepted. Reference to the dependence on the affected biome has been added to the description (footnote 15).
44839	28	39	28	39	What is the meaning of "higher"? Higher than what? (If the dimension is one of time, then "continued warming" or suchlike would be a better term.) [Markku Rummukainen, Sweden]	Accepted. This has been clarified to "higher global warming levels".

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27977	28	39	28	40	Temperature is an indirect element; it is humidity (water vapour) that is an important factor. The result therefore depends on the region. We propose to delete the beginning of the sentence. The scale of validity of this result also needs to be clarified. [Eric Brun, France]	Noted. This part has been thoroughly revised and only a description of the different types of drought remains in the final (approved) SPM (footnote 15). The reader is referred to the underlying chapters and the TS for the process description. A3.2 (in final SPM) now reads:"... Human-induced climate change has contributed to increases in agricultural and ecological droughts in some regions due to increased land evapotranspiration (medium confidence)."
9521	28	39	28	43	It would be helpful to list specific water limited regions will be impacted by increased aridity. [Joelle Joelle Gergis, Australia]	Noted. HS11.3 now refers explicitly to aridity.
27979	28	40	28	40	Could you focus more on consequence on water availability? For example: "resulting decreased of the water availability and soil drying ..." [Eric Brun, France]	Not applicable. This part has been thoroughly revised and only a description of the different types of drought remains in the final (approved) SPM (footnote 15). The reader is referred to the underlying chapters and the TS for the process description. A3.2 now reads:"... Human-induced climate change has contributed to increases in agricultural and ecological droughts in some regions due to increased land evapotranspiration (medium confidence)."
25927	28	41	28	43	We suggest to complement this sentence with the information contained in chapter 8, page 6, lines 41-43: "There is medium to high confidence in an expansion of arid areas towards the midlatitudes, and in pronounced drying in the Mediterranean, southern Africa, southern Australia, southern North America, Central America and northeastern Brazil. " [Don Alfonso Pino Maeso, Spain]	Noted. Statement C.2.4 of the final version now states: "Region-specific changes include intensification of tropical cyclones and/or extratropical storms (medium confidence), increases in river floods (medium to high confidence), reductions in mean precipitation and increases in aridity (medium to high confidence), and increases in fire weather (medium to high confidence)." The reader is referred to the TS and chapter 8 for details on regions.
97361	28	41	28	43	Please include here the information found in the TS (TS-44:16-19): "There is medium to high confidence in pronounced drying in the Mediterranean, southern Africa, southern Australia, southern North America, Central America and north-eastern Brazil." [Nicole Wilke, Germany]	Noted. Statement C.2.4 of the final version now states: "Region-specific changes include intensification of tropical cyclones and/or extratropical storms (medium confidence), increases in river floods (medium to high confidence), reductions in mean precipitation and increases in aridity (medium to high confidence), and increases in fire weather (medium to high confidence)." The reader is referred to the TS and chapter 8 for details on regions.
130179	28	42			Revise to state "Arid conditions typical of the subtropics are expected to expand..." [Trigg Talley, United States of America]	Noted. This level of detail has been removed from the SPM.
130181	28	45			Because the changes in daily precipitation are so central to how climate change will manifest, suggest to revise the beginning of the sentence by stating "Daily to intraseasonal precipitation variability..." [Trigg Talley, United States of America]	Rejected. As the revised SPM is much shorter than before, we had to combine several bullet points and get rid of some material. As a result, variability in the water cycle is no longer the sole focus of bullet HS7.1 but one of the topics covered. Due to space constraints, it is therefore not possible to go too much into the details of variability.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50341	28	48	28	48	extratropics' might not mean much to policymakers - is there a simpler way of describing this region? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Extratropics no longer mentioned in HS7.1
130183	28	49	28	50	Revise the sentence to read "Decadal to multi-decadal internal variability will strongly affect near-term water cycle trends under all emission scenarios and in all regions." [Trigg Talley, United States of America]	Not applicable. Sentence on internal variability of the water cycle removed from revised SPM, to shorten the document
80149	28	49	28	51	Internal variability is affecting water cycle not just in the near-term but proportionally it has the highest effect in the near-term. It is very much season, area, variable and lead time dependent. [Lilian Fejes, Hungary]	Not applicable. Sentence on internal variability of the water cycle removed from revised SPM, to shorten the document
65621	28	49	28	51	Suggest clarification as this statement is true for the whole century, not just the near term. This statement is about size of natural variability relative to anthropogenic response. Relative size reduces as time goes on, but not the variability per se. [Kushla Munro, Australia]	Not applicable. Sentence on internal variability of the water cycle removed from revised SPM, to shorten the document
78971	28				Section C4 is useful and important but would benefit from being further refined in view of focusing on the most policy relevant aspects and making the key statements easier to read in the headline; a link with the next section on extremes may help. [Martine Vanderstraeten, Belgium]	Accepted.HS7 is now much shorter (both the headline statement itself and the bullet points). Additionally, this part has been streamlined and focuses on what's most policy-relevant. Last, the subsection now includes a part on extremes of the water cycle (HS7.2)
93769	29	1	29	3	This sentence suggests that warming always have positive effects on ecosystem productivity. However, the message from Section 5.4.3 is not as straightforward at all, and rather lists a number of processes that can have either positive or negative effects (this depending sometimes on the region), and all associated with substantial uncertainties. [Quentin Lejeune, Germany]	Noted. Text removed from here
65623	29	1	29	3	Suggest prefacing this sentence with , e.g.: "productivity is generally increased for modest warming..." Otherwise this will be confusing to some readers. [Kushla Munro, Australia]	Not applicable. Text removed from here
81219	29	1	29	5	The way subsection C.4.6 is written make it more adapted for impact assessment, the main message it would present from the physical science basis aspect is not clear. Please rephrase it. [Fatima Driouech, Morocco]	Noted. Text removed from here
50343	29	1	29	5	This section as written is very helpful. However, it would also be helpful to add in a reference to the effect that extreme weather will additionally have on ecosystem productivity on top of these effects, and also to give an overall global picture of the balance between water availability / water use efficiency (not just for drying areas). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text removed from here
42263	29	1			C4.6: L1 "vegetation productivity" = growth? [Tina Christensen, Denmark]	Not applicable. Text removed from here
36223	29	1			emerging limitations' - here we have a totally different use of emerge. Can you just drop this word? reads well without. [Michael PRATHER, United States of America]	Not applicable. Text removed from here
9523	29	2	29	2	Provide specific examples of what is meant by 'drying areas'. [Joelle Joelle Gergis, Australia]	Not applicable. Text removed from here
9741	29	3	29	5	another piece of apparent good news from global warming so needs careful presentation [Jonathan Lynn, Switzerland]	Not applicable. Text removed from here

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104207	29	3	29	5	Sentence: "Increasing atmospheric CO2 will generally increase water-use efficiency of plants (high confidence) and would partly counteract water losses from rising evapotranspiration in a warmer climate". Increased WUE cannot counteract "water losses from rising evapotranspiration", as changes in ET include any changes in WUE. It could counteract changes in potential evapotranspiration (i.e., making actual ET less than it would be without the improved WUE) and/or it could counteract some of the impacts (e.g., on NPP or crop production). Please clarify, including what is meant by "partly", which is currently too indetermined. Please consider providing further details to clarify that this does not prevent risks linked to water stress. [Philippe Tulkens, Belgium]	Not applicable. Text removed from here
97363	29	3			Please explain that water-use efficiency of plants is referring to CO2 fertilization. [Nicole Wilke, Germany]	Not applicable. Text removed from here
130185	29	3			In informing policymakers, it is important to make it clear whether CO2 fertilization leading to increased water-use efficiency by plants is an uncapped linear relationship or this relationship saturates with high levels of CO2. [Trigg Talley, United States of America]	Not applicable. Text removed from here
8165	29	4	29	4	How much is increasing CO2 counteracting evaporation (e.g. for a couple typical scenarios/timeframes). [Frank Dentener, Italy]	Not applicable. Text removed from here
130187	29	4	29	5	In informing policymakers, it is important to make it clear that CO2 fertilization leading to increased water-use efficiency by plants partly counteracting water losses from rising evapotranspiration in a warmer climate will not be a significant deterrent to the impacts of high levels of global warming. [Trigg Talley, United States of America]	Not applicable. Text removed from here
112165	29	8	29	8	This title is difficult to interpret. Should it read: "Future changes in extremes of climate impact-drivers"? If not, then what is the definition of an "extreme"? [Timothy Carter, Finland]	Not applicable. Text has been changed in HS6.1.
12681	29	8	29	42	Marine heat waves are not included. [Lijing Cheng, China]	Taken into account. Information on marine heatwaves has been included
14569	29	8	30	29	As indicated in Box 3 Table 1, all Coastal and Oceanic CIDs in almost all regions are projected to increase with high confidence. But this is not mentioned in the main text of SPM C. Is there a good reason for this omission? [Roshanka Ranasinghe, Netherlands]	Taken into account. This is now mentioned in the revised Section C (C.2.5, C2.6) of the final (approved) SPM.
111675	29	8	30	30	This section is another part of the SPM where there is a missed opportunity to provide storyline information (as advertised inBox SPM.1). The section currently focuses on broad, qualitative information, which is worthwhile but gives no indications of the possible magnitudes of change, and hence their importance. The section would be stronger and more impactful with some illustrative storylines. I know this creates difficulties with what regions/ timeframes to select, but perhaps some meta-analysis of relevant literature could help (identifying some common storylines that apply to mulitple places). [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Storylines of rare extremes have been included in HS12

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
14567	29	8	33	25	C5 attempts to combine the assessments done by warming level in Ch 11 and by assessments done by scenario in Ch 12. Furthermore, C5 attempts to separate extremes from CID, when in fact most of what is described here as extremes are in effect CIDs (or a component of a CID). For example, extreme heat is a CID by itself, and TCs are part of the Severe Wind storm CID. These two structural decisions have resulted in more than 90% of the paragraphs in C5 being directly related to Ch 11 while 90% of the Ch12 assessment is confined to SPM Box 3, when in fact (as indicated in the above comment) projections by scenario would be the most relevant and useful information sought by the average policy maker(i.e. the main target audience of this SPM) engaged in local to regional adaptation . Thus I find the current structure of C5 to be far from ideal. If, as suggested above, SPM C were to be broadly separated into two subsections where one deals with projections by scenarios and the other by warming level this problem would also be automatically solved as all Ch 12 outputs would go in the former and all Ch 11 outputs would go in the latter. [Roshanka Ranasinghe, Netherlands]	Taken into account. The statements have been substantially restructured in a more balanced way.
130189	29	8	33	27	Extreme weather events -- storms, heat, drought, wildfires, etc. -- in developing parts of the world have the potential to trigger mass migration. If people move to urban areas in search of economic opportunity, food, and shelter, the pressure on urban government institutions will mount. If needs -- jobs, food, housing, etc. - - are not met, governments may become instable, potentially threatening U.S. security interests. [Trigg Talley, United States of America]	Rejected. This relates to the assessment of WG2
69401	29	8	33	29	Regarding the Section C.5, there seems to be an overlap between the content of the text and Table SPM.2. It seems that the table is more suitable here, and the text could be limited to the essential messages that are relevant to the policymakers. [Kaoru Magosaki, Japan]	Not applicable. Text has been changed in HS6.1.
97365	29	8	38	18	Section C needs to convey the message that the level of warming and the trajectory matter in a clearer way. Much of the current text untruly suggests that these changes will happen anyway or that the level of warming does not matter. Please supplement qualitative and contextualized statements as much as possible with concrete, quantitative information. [Nicole Wilke, Germany]	Accepted. We have clarified this aspect in the revised SPM.
41823	29	9	29	9	In opposition to the historical trends, here it is not mentioned the projected increase in the atmospheric evaporative demand or the atmospheric dryness, which are expected to increase a lot. This would explain the mentioned stronger severity of soil moisture dryness than in precipitation in several regions worldwide. This is not related to possible changes in the drought duration/intensity/frequency [Sergio Vicente-Serrano, Spain]	Rejected. Evaporative demand was covered in C4. The future of the water cycle is now covered in HS.7. The specific suggestion is considered too detailed/technical for a concise SPM.
25929	29	10	29	10	Please specify whether "regional temperature" refer to GSAT. [Don Alfonso Pino Maeso, Spain]	Rejected. The text is meant to be "regional temperature ... extremes". Also note that the headline statement (now HS6) has been significantly rewritten in the SPM.
40821	29	10	29	11	SPM <-> TS: On precipitation, the TS seems to have a "high confidence" expert judgement, while the SPM uses "very likely". " The increase in the magnitude of extreme precipitation will be, in general, proportional to the global warming level, with an increase of 7% and a slightly smaller rate in the 50-yr event of annual maximum 1-day and 5-day precipitation per 1°C warming, respectively (high confidence). There can be large differences in the increase regionally. {Cross-Section Box TS.1 Figure 1, Cross-Section Box TS.2 Figure 3, Table TS.8, 11.4.5}" Maybe the two could be harmonized? [TSU WGI, France]	Taken into account. The relevant statement in the final TS and SPM are consistent.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
40827	29	10	29	11	SPM <-> TS: On temperature, the TS seems to have a "high confidence" expert judgement, while the SPM uses "very likely". " In most regions, changes in the magnitude of temperature extremes are proportional to global warming levels (high confidence). The likelihood of temperature extremes generally increases exponentially with increasing global warming levels (high confidence). {11.3, 11.9}" Maybe the two could be harmonized? [TSU WGI, France]	Taken into account. The relevant statement in the final TS and SPM are consistent.
20349	29	10	29	11	Using the word "proportional" needs some thinking. Throughout this introductory paragraph, several statements refer to the magnitude of extremes. Is the reader to understand that these magnitudes vary linearly with GSAT, as implied by the word "proportional"? [philippe waldteufel, France]	Taken into account. The headline statement has been completely rewritten. But in the main text different words have been used to more precisely reflect the relation between warming and changes in the magnitude and frequency of extremes.
80151	29	10	29	13	Not clear what proportional means in this context. Also, it is not defined what the additional half-degree warming is added to: to the observed 0.91 °C or to the 1.5 °C reaching 2 °C? To change of extremes and impacts are way larger for the jump from 1.5 to 2 than for 1 to 1.5 °C. Record-breakings are also above the 1/n theoretical value so not it is definitely not linear or proportional. These also appear in C.5.1 and C.5.3 paragraphs. [Lilian Fejes, Hungary]	Taken into account. "Proportional" is reworded. "Additional half-degree warming" is defined as "every additional 0.5C". See B.2 and B2.2.
97367	29	10	29	13	We appreciate the clarity of these two sentences and encourage the authors to keep them as they are. Please keep them also in TS-58-47. [Nicole Wilke, Germany]	Taken into account. Similar sentences are retained in HS6.2
42367	29	10	29	15	beginning of C.5 headline box is difficult to read. Message in C5.1 (L23-28) are more readerfriendly and might be used in box instead. [Tina Christensen, Denmark]	Not applicable. The headline statement is not used in final version of SPM.
77067	29	10	29	20	see earlier comments on narrative and terms used for the "energy budget". How much energy is needed to warm the world by 0.5C? [Emer Griffin, Ireland]	Rejected. WGI assesses remaining carbon budgets, not energy budgets for future global warming. Energy sector budgets are the mandate of WGIII.
104209	29	10	29	20	The chapeau paragraph of C5 should contain high-level elements about heat waves and other heat-related events, such as forest fires. [Philippe Tulkens, Belgium]	Not applicable. The headline statement is not used in final version of SPM.
9525	29	10	29	20	Phrasing needs work. Suggest the following edits: Line 10-11: Projected changes in the magnitude of regional temperature and precipitation extremes are very likely proportional to the level of global warming. An additional half degree of global warming will cause...' Also change 'prolonged negative anomalies in precipitation' to simply 'declines in precipitation' and 'highest category tropical cyclones' to most 'severe tropical cyclones' – remember we are writing for a non-expert audience. It is unclear what you mean by 'similar sectors' here, please clarify or drop for simplicity to just read 'concurrent extremes affecting different regions'. [Joelle Joelle Gergis, Australia]	Taken into account. The headline statement is removed but the related text is retained and reformulated to improve clarity in several sub-bullets under HS6.
31563	29	10	29	20	Marine heat waves and sea level extreme are missing from the chapeau paragraph. [Jean-Baptiste SALLEE, France]	noted.
90205	29	10	29	20	The last sentence of this headline statement is very difficult to understand and could be dropped. [Georges Gehl, Luxembourg]	Taken into account. The sentence is reformulated with better clarity and is C.2.7 in the final (approved) version of SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
105601	29	10	29	20	Here in section C.5 I miss a clear narrative the extremes events are more extreme under higher levels of global warming. C5.2 seems to say nothing about scenarios. This is perhaps true of the whole of section C. Policy choices can determine the magnitude of many of the changes discussed but this message is not particularly clear. This is clearly demonstrated in SMP.9 so perhaps cross-reference that? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The new text reflects 1) changes in extreme become larger with more warming. Note that some extremes such as cold extremes get less extreme so the use of change. 2) hot extremes and heavy precipitation becomes more extreme.
130191	29	10	29	35	C.5.2 states that "There is high confidence that many regions will experience heat stress conditions above critical thresholds for health, agriculture and other sectors." This is a major finding that should be brought to policymakers' attention by including it in the pink box summary at the beginning of the section. This can be done by expanding the third sentence in the summary into two sentences that bring home the critical nature of expected increases in heat extremes, as follows: "Warm extremes are projected to become more frequent (virtually certain), EXCEEDING CRITICAL STRESS THRESHOLDS FOR HUMAN HEALTH AND AGRICULTURE IN MANY REGIONS (HIGH CONFIDENCE). Cold extremes WILL BECOME less frequent (extremely likely) and precipitation extremes more frequent in most locations (very likely)." [Trigg Talley, United States of America]	Not applicable. The headline statement is not used in final version of SPM.
36225	29	10			Headline: I would just use the first two sentences. The details can be in the bullets below. [Michael PRATHER, United States of America]	Not applicable. The headline statement is not used in final version of SPM.
53503	29	10			hot temperature and heavy precipitation extremes? May be less accurate for cold extremes (due to snow and ice processes) and for dry extremes (due to soil moisture limitation)? [Hervé Douville, France]	Taken into account. The word "proportional" is not used in the new text.
15385	29	11	29	11	It is better to add more reasons why only in this subsection, "an additional half degree of global warming" is focused. Also in C.5.1 (L23). [Masaki Satoh, Japan]	Taken into account. The text is reformulated to indicate "every additional half a degree warming" to provide clarity. There is not a room in SPM to provide detailed explanation for the use of half degree rather than other measure say 0.3 or 1C.
112167	29	11	29	11	Why is an additional half degree of global warming discussed here - what is its significance? Why not refer to an additional 1 deg C or any other amount of warming? If this is supposed to be equivalent to crossing the 1.5 deg C warming threshold, then this needs to be explained and justified here, or should refer back to where this is justified and explained. [Timothy Carter, Finland]	Taken into account. The text is reformulated to indicate "every additional half a degree warming" to provide clarity. There is not a room in SPM to provide detailed explanation for the use of half degree rather than other measure say 0.3 or 1C.
44841	29	11	29	11	Suggest "Each additional half degree...". [Markku Rummukainen, Sweden]	Accepted. The new text states "every additional ...".
65625	29	11	29	11	Please clarify this statement. We presume this is 2 degrees relative to 1.5 degrees. If so, this should be stated as this is the literature assessed. [Kushla Munro, Australia]	Taken into account. This is not meant to be 2C relative to 1.5C. The new text states "every additional ...". The emphasis is every increment of warming is bad.
87259	29	11	29	13	This sentence sounds a little bit strange/is not really a main message in the bold text. We advise to skip [Marcel Berk, Netherlands]	Not applicable. The headline statement is not used in final version of SPM.
32385	29	11			"An" additional half degree or "every" additional half degree? If it is the former it should be stated to which warming levels this refers. [Clemens Schwingshackl, Norway]	Taken into account. The new text states "every additional ...".

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97369	29	12	29	13	"precipitation extremes (very likely) at the global scale": Precipitation regimes vary a lot on a global scale (tropical, monsoonal, extratropical, ...), some are better covered by models (advective) than others (convective). Please clarify if the statement "very likely" for additional change with a half-degree warming does apply to all regimes or differentiate. [Nicole Wilke, Germany]	Taken into account. 1) The headline statement is not used in final version of SPM. 2) Note that while precipitation regimes are different in different regions, the assessment of detectable change in extreme precipitation on global scale is supported by multiple lines of evidence, including the intensification of heavy precipitation in the observation. See Chapter 11 for details of the assessment.
82541	29	14	29	14	It is stated here that decreases in cold extremes are extremely likely, which does not match the virtually certain assessment at line 29 (and in Chapter 11). [Blair Trewin, Australia]	Taken into account. The assessment in SPM is checked against underlying chapter 11's assessment. Note that the revised text (HS6.3) can only include some examples due to space limitation.
101591	29	14			Change "(extremely likely) and precipitation" to "(extremely likely), and precipitation" [Knut Nadelhoffer, United States of America]	Editorial. Report to be professionally copy-edited prior to publication, this kind of issues will be fixed then, if not before
7701	29	15	29	15	It is suggested to delete the qualifier "negative" in the following sentence: "The frequency and severity of prolonged negative anomalies in precipitation .." because anomalies can be positive (higher precipitation) or negative (less soil moisture). The current wording is therefore confusing. Any such anomalies might have negative impacts on human and natural systems - however, this is outside the scope of WGI assessment. [Klaus Radunsky, Austria]	Accepted. The word "negative" is replaced with words that indicate clearly the reduction in precipitation/soil moisture or increase in drought condition.
131779	29	15	29	15	Is there any way to avoid an abstract term such as "prolonged negative anomalies" here? You are trying to communicate that there is going to be more/less/longer rain, more/less soil moisture and more/less streamflow than normal, correct? A technical term such as negative anomalies makes it really difficult to understand your key findings. [Hans Poertner and WGII TSU, Germany]	Accepted. The word "negative" is replaced with words that indicate clearly the reduction in precipitation/soil moisture or increase in drought condition.
86989	29	15	29	16	There seems to be some overlap between findings in this highlighted conclusion and the previous one that deals with Future changes in the water cycle, and associated projections for extremes. We think that it might be best to deal with extremes separately under this section, while more general changes for the water cycle is dealt with under section C.4. Please consider to rearrange the findings accordingly. [Oyvind Christophersen, Norway]	Taken into account. These are merged in the final version of SPM.
17505	29	15			negative anomalies: would it be correct to say less-than-average, to simplify this? The text in a 'highlighted conclusions' box that forms part of the concise narrative, so it might be helpful to ensure it is very accessible (it matters less at C.5.4 where the reader can get a sense of what it means from the subsequent text). [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The word "negative" is replaced with words that indicate clearly the reduction in precipitation/soil moisture or increase in drought condition.
87261	29	16	29	16	The word "streamflow" needs further explanation [Marcel Berk, Netherlands]	Not applicable. The headline statement is not used in final version of SPM.
15451	29	16	29	20	The statement "The highest category tropical cyclones will be associated with increased maximum wind speed and precipitation with increasing warming levels (high confidence)" may not correctly summarize the relevant conclusions in 11.7.1.5. There is high confidence that average peak wind speeds and precipitation rate of tropical cyclones will increase globally, not just associated with the highest category tropical cyclones only. Also, there is high confidence that the proportion of Cat 4-5 tropical cyclones will increase globally. Please consider revision. [SAI MING LEE, China]	Taken into account. The headline statement (now HS6) has been completely rewritten and shortened and the cyclone statement no longer features there. The assessment in 11.7.1.5 is revisited and is now used in SPM HS6.4.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130193	29	17	29	18	[CONFIDENCE] This should be medium-to-high confidence (as in the WMO TC/climate assessment, Knutson et al. 2019b) for the statement that TCs will have increased maximum wind speed and precipitation rates -- not high confidence. If this is not available due to IPCC rules, then medium confidence for both. Rationale for windspeed: There is good model agreement on an increase but evidence is still lacking for a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). One of the tricky things about future changes of mean intensity, or of the related change in the shape of the pdf of intensity) is that it depends not just on SST but also on details of the atmospheric profile of temperature change in the tropics. Both models and theory indicate this. For Emanuel potential intensity it's through outflow temperature changes, while in a high-resolution hurricane prediction model, it's the amount of upper tropospheric warming relative to surface warming as discussed, for example, in Tuleya et al. (2016: Impact of upper tropospheric temperature anomalies and vertical wind shear on tropical cyclone evolution using an idealized version of the operational GFDL hurricane model. Journal of the Atmospheric Sciences, 73(10), DOI:10.1175/JAS-D-16-0045.1.). Unfortunately there is also uncertainty in precisely how tropical upper tropospheric temperature is going to evolve in the future, which contributes to uncertainty in the TC intensity projections, along with changes in subsurface ocean stratification, salinity, etc. Rationale for TC precipitation rate (medium to high confidence at most): This projection has high level of agreement among existing modeling studies (although not as many studies have examined this as TC frequency change), the mechanistic understanding is strong, as is support for	Considered. The high confidence statement is backed up by underlying chapter assessment.
44843	29	18	29	19	The sentence "Concurrent extreme events..." is a bit vague. What does "similar sectors" mean? [Markku Rummukainen, Sweden]	Taken into account. The headline statement is not used in the final version of SPM, but the relevant text is now more specific (see C2.7 in the final (approved) SPM).
86475	29	18	29	19	This sentence is very difficult to understand. Please rewrite. [Ala Taimar, Estonia]	Taken into account. The headline statement is not used in the final version of SPM, but the relevant text is now more specific (see C2.7 in the final (approved) SPM).
87263	29	18	29	19	This message is not clear. We advise to skip [Marcel Berk, Netherlands]	Taken into account. The headline statement is not used in the final version of SPM, but the relevant text is now more specific (see C2.7 in the final (approved) SPM).
25931	29	19	29	19	Please provide an explanation of what is meant by "similar sectors" in this sentence. [Don Alfonso Pino Maeso, Spain]	Taken into account. The headline statement is not used in the final version of SPM, but the relevant text is now more specific (see C2.7 in the final (approved) SPM).
97371	29	19	29	19	"Concurrent extreme events affecting similar sectors in different regions will become more frequent (high confidence)." --> How are "regions" defined here? "typological regions" or "sub-continental domains" (cf. glossary)? [Nicole Wilke, Germany]	Not applicable. The sentence no longer features in the revised text.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
19549	29	19	29	19	At this stage the reader is not sure what is meant by "sector" in this WG1 report. One must wait until page 44 line 16 to obtain this information. [philippe waldteufel, France]	Taken into account. The headline statement is not used in the final version of SPM, but the relevant text is now more specific (see C2.7 in the final (approved) SPM).
50347	29	19	29	22	It is unclear in C5.6 whether "1% probability events" is the same as "historical centennial events" referred to in the SROCC SPM. The text from section 9.6.4.2 of this underlying report could be used here instead i.e. "what is currently a 1-in-100 year ESL height will be expected once or even multiple times per year in the future in many locations" [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The wording is specific in the final version of the SPM (see C.2.5: "that occurred once per century in the recent past...").
108561	29	23	29	23	Italics went too far, take out the 'a' [Jason Donev, Canada]	Taken into account. Statement has been rephrased and italics corrected.
104211	29	23	29	23	Can this statement be more precise than 'detectable', e.g. quoting numbers/ranges [Philippe Tulkens, Belgium]	Taken into account. Statement has been rephrased.
69403	29	23	29	23	It is unclear what "an additional half degree of global warming" means. If it is increase in GSAT relative to the current period such as 1995-2014 in C1.3, it should say so. It would be helpful to add clear description on this matter. [Kaoru Magosaki, Japan]	Taken into account. Statement has been rephrased.
41251	29	23	29	23	Why half degree? Does this mean that each half degree leads to a detectable change? If so, perhaps add "each" into the sentence? [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Statement has been rephrased.
42415	29	23	29	23	General comment : there is a need to secure consistency in the use of the extent of global warming. Does this sentence refer to 1,5 degrees above preindustrial levels? Or 1,6 degrees (Tabel SMP 3 estimates a 1.1 degree warming for the period 2010-2019 compared to 1850-1900)t [Tina Christensen, Denmark]	Taken into account. This statement is correct independent of the reference period as the changes are continuous.
8167	29	23	29	23	Can this statement be more precise than 'detectable', e.g. quoting numbers/ranges [Frank Dentener, Italy]	Taken into account. Text has been rephrased to make this clearer.
26351	29	23	29	23	that an additional -> "a" from "an" is in italics [María Santolaria-Otín, France]	Not applicable. Sentence has been rephrased.
29425	29	23	29	23	formatting and language [Joachim Fallmann, Germany]	Not applicable. Sentence has been rephrased.
25933	29	23	29	24	We think the original sentence contained in chapter 11, page 3, lines 20-22 is clearer: "An additional half degree of global warming would be sufficient to cause further detectable changes in temperature extremes (virtually certain) and precipitation extremes (very likely) at the global scale" [Don Alfonso Pino Maeso, Spain]	Taken into account. Statement has been rephrased.
97373	29	23	29	24	"precipitation extremes (very likely) at the global scale": Precipitation regimes vary a lot on a global scale (tropical, monsoonal, extratropical, ...), some are better covered by models (advective) than others (convective). Please clarify if the statement "very likely" for additional change with a half-degree warming does apply to all regimes. [Nicole Wilke, Germany]	Taken into account. The statement clearly applies to a globally aggregated perspective. This has been clarified in the revised statement.
42613	29	23	29	24	Please clarify "an additional half degree of global warming..." as compared to what? For every half degree of global warming or compared to the warming we have experienced so far? [Sofie Schöld, Sweden]	Taken into account. A quantification is given at the global level and it is made clear that every increment of warming matters.
9527	29	23	29	26	Poorly expressed, unclear as written. Suggest something like: An additional half degree of global warming will cause further detectable changes in temperature extremes (virtual certain) and precipitation extremes (very likely) at the global scale. It is likely that the frequency of historically rare temperature and precipitation extremes will increase under higher warming. [Joelle Joelle Gergis, Australia]	Taken into account. Statement has been rephrased.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97375	29	23	29	26	Please quantify these changes. In addition, this sounds as if the level of warming does not matter. [Nicole Wilke, Germany]	Taken into account. A quantification is given at the global level and it is made clear that every increment of warming matters.
50345	29	23	29	26	In C5.1 please could you specify what the additional half a degree of global warming referenced here is in relation to, for example whether it is relative to current levels, or every extra half a degree. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This statement is correct independent of the reference period as the changes are continuous.
50349	29	23	29	26	When the extra half degree of warming is mentioned – does this refer to 1.5C to 2C? Or other levels as the effect of an extra half a degree is likely non-linear - please clarify. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This statement is correct independent of the reference period as the changes are continuous.
36227	29	23			detectable' by whom? Here we have further use of words like 'emerge'. Is this a very specific scientific usage (p<0.0000)? or something that the voting public can see -- I hope the latter if it is in the SPM. [Michael PRATHER, United States of America]	Taken into account. Text has been rephrased to make this clearer.
42265	29	24	29	26	C5.1 L24-26: Important message, but hard to read [Tina Christensen, Denmark]	Taken into account. Sentence has been rephrased.
36229	29	24			change 'for' to 'in' to maintain parallel structure. [Michael PRATHER, United States of America]	Taken into account. Sentence has been rephrased.
77579	29	25	29	25	"It is likely that the frequency of rarer temperature and precipitation extremes will increase more than that...". This statement suggests that rare cold extreme temperatures will also increase (which is not the case). [Emer Griffin, Ireland]	Taken into account. Sentence has been rephrased to distinguish between hot and cold temperature extremes.
15383	29	25	29	25	"rarer tempetature" can be more specific to be "rarer high temperature". [Masaki Satoh, Japan]	Taken into account. Sentence has been rephrased to distinguish between hot and cold temperature extremes.
27981	29	25	29	26	We suggest to change "rarer temperature" into "rarer hot temperature" since presently rare cold extrens will not see there frequency increasing under higher warming. [Eric Brun, France]	Taken into account. Sentence has been rephrased.
87189	29	25	29	26	Please consider rephrasing this probabalistic statement in terms that are better understood by a non-expert reader, as the formulation at present is slightly strange. Moreover, an explanation or example of what is meant by 'rarer' and 'less rare' events would be helpful in understanding the different type of events being described. [Oyvind Christophersen, Norway]	Taken into account. The sentence is rephrased but the term "rarer" is kept as it is well defined.
36231	29	25			rarer', 'less rare': this is not intuitive here, and I thought I understood how the prob dist of T changed with warming. [Michael PRATHER, United States of America]	Taken into account. The sentence is rephrased but the term "rarer" is kept as it is well defined.
44845	29	26	29	26	What is the meaning of "higher"? Higher than what? (If the dimension is one of time, then "continued warming" or suchlike would be a better term.) [Markku Rummukainen, Sweden]	Taken into account. Sentence has been rephrased.
77581	29	28	29	28	"It is virtually certain that further increases in the likelihood..". Mixing "certainty" & "likelihood" might cause confusion. I assume the term "likelihood" here is not used in the IPCC statistical sense. Perhaps rephrase? [Emer Griffin, Ireland]	Taken into account. Sentence has been rephrased.
15387	29	28	29	28	"certain" should be italic. [Masaki Satoh, Japan]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
26353	29	28	29	28	It is virtually certain that further increases -> "certain" should be in italics [María Santolaria-Otín, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32387	29	28	29	31	Is this independent of the emission scenario? [Clemens Schwingshackl, Norway]	Considered. This is independent of the emissions scenarios and details are provided in underlying Chapter 11 assessment.
104213	29	28	29	35	C.5.2. would benefit quantifying what is meant with decreases and increases. [Philippe Tulkens, Belgium]	Taken into account. The revised texts in B.2.3 and B2.4 in the final (approved) SPM provides some quantification of the changes.
17507	29	28	29	35	In all these cases, is this in proportion with global warming? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. HS6 is now clearer on what is proportional to global warming (see HS6.2)
8169	29	28	29	35	C.5.2. would benefit quantifying what is meant with decreases and increases. [Frank Dentener, Italy]	Taken into account. The revised texts in B.2.3 and B2.4 in the final (approved) SPM provides some quantification of the changes.
36233	29	28			I have trouble reading this. The likelihood is the probability of a temperature extreme occurring. But If the 20-year return T is evaluated in 2100, it will still be a 20-year return, but it will be a larger temperature. The other way of taking current extremes like T-20y from current climate normals, then that T level will become more frequent. (So it will become less 'extreme high probability') The bullet here is confusing, can you make it simpler? [Michael PRATHER, United States of America]	Taken into account. The text is rephrased to improve clarity.
65627	29	29	29	35	Suggest additional clarification, e.g.: "Unprecedented high monthly temperatures are projected to occur frequently prior to mid-century, especially at low latitudes. After mid-century the frequency will decline under the strongly mitigated scenarios, but rise under the unmitigated or weakly mitigated scenarios". See Power and Delage Nature Clim Change 2019. [Kushla Munro, Australia]	Not applicable. C5.2 (now HS6.3) has been significantly rewritten and HS6 now focuses on effect of climate change that are proportional to global warming levels (as implicitly explained in HS6).
38961	29	30	29	30	If there is a definition for hot days and hot nights that is valid around the world, I would suggest to add it here to make sure this does not sound subjective. [Maike Nicolai, Germany]	Taken into account. Text is rephrased and the wording "hot days" or "hot nights" is not used in the final version of SPM.
19551	29	31	29	33	These issues should be addressed and quantified in a "limits to adaptability" section within the WG2 report. Please consider adding a reference to this hoped for section of the WG2 report! [philippe waldteufel, France]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
131993	29	31		33	The statement on critical thresholds for health etc is clearly beyond the mandate of WGI. [Hans Poertner and WGII TSU, Germany]	Rejected. The 3rd section of the revised SPM (Climate Information for Risk Assessment and Regional Adaptation) is meant as a handshake to WGII. This climate information is relevant for risk assessment but it is the mandate of WGII to assess the risk itself.
27983	29	32	29	33	These impacts seem to only refer to human impacts. It would be relevant to also include a reference to non-human impacts (ie: on biodiversity). [Eric Brun, France]	Rejected. The 3rd section of the revised SPM (Climate Information for Risk Assessment and Regional Adaptation) is meant as a handshake to WGII. This climate information is relevant for risk assessment but it is the mandate of WGII to assess the risk itself.
50351	29	33	29	33	If possible could you briefly list the significant 'other sectors' affected by critical heat thresholds, or remove this terms as it doesn't provide additional useful information. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in the final SPM. 'other sectors' no longer mentioned in C2.1
97377	29	35	29	43	Please quantify these changes. In addition, this sounds as if the level of warming does not matter. [Nicole Wilke, Germany]	Taken into account Quantities have been added wherever possible. We have also clarified the message that the level of warming does matter.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25935	29	37	29	38	It would be useful to complement this sentence with information on frequency, as contained in chapter 11, page 7, lines 34-35: "Over almost all land regions, it is very likely that extreme precipitation will be more intense and more frequent in a warmer world." [Don Alfonso Pino Maeso, Spain]	Taken into account. Wording similar to the suggested is used in HS6.4.
9529	29	37	29	43	Cross reference to chapter 8 needed, relevant parts of section 8.4. [Joelle Joelle Gergis, Australia]	Taken into account. Chapter 8 is referenced.
36235	29	37			C.5.3 is well written - but it now competes with the (more confusing) pink headline of the section. ALSO it seems to overlap with the C.4 Hydorology section above, and this needs to be reconciled and not repeated. [Michael PRATHER, United States of America]	Taken into account. Headline statements have been significantly revised and streamlined. They are now shorter and simpler and they express in simple terms the key conclusions of the report which are then substantiated in the supporting bullets. Additionally, the narrative of new section 'possible climate futures' (former section C) has been completely revised. As a result, the overlap has been removed.
130195	29	38	29	40	[CONFIDENCE] For Tropical cyclones precipitation rate this should not state "will increase" and should not imply "very likely" or have "high confidence". For tropical cyclone precipitation rate this should be medium to high confidence at most, and if split wording is not available, then medium confidence. This projection has high level of agreement among existing modeling studies (although not as many studies have examined this as TC frequency change), the mechanistic understanding is strong, as is support for anthropogenic increases in total precipitable water, a key ingredient. What remains missing is a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). Recent detection/attribution studies for the Harvey event by Risser and Wehner and van Oldenbourg et al., while of high quality, analyze observed long-term changes in extreme precipitation in general, not tropical cyclone precipitation. Additionally, the Harvey event was mainly due to the multi-day stall-out of the hurricane in the region. [Trigg Talley, United States of America]	Considered but the suggested change not accepted. The assessment is supported by underlying Chapter 11 assessment.
25937	29	39	29	39	It would be useful to provide an explanation on "atmospheric rivers" [Don Alfonso Pino Maeso, Spain]	Not applicable. The text does not mention the term anymore.
27985	29	39	29	39	The term "atmospheric rivers" is very unfamiliar to policy-makers and should be replaced with more familiar terms, such as "series of low-pressure systems". [Eric Brun, France]	Not applicable. The text does not mention the term anymore.
131781	29	39	29	39	"convective" - Technical and not clear term, consider using another word? [Hans Poertner and WGII TSU, Germany]	Accepted. "Convective" is not used.
87265	29	39	29	39	The term "atmospheric rivers" needs explanation [Marcel Berk, Netherlands]	Not applicable. The text does not mention the term anymore.
42667	29	39			For the SPM, where the readership is policymakers, the inclusion of 'atmospheric rivers' seems out of place in this list. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text does not mention the term anymore.
53505	29	40	29	41	although dynamical processes may lead to even larger rates depending on region, season and weather phenomenon (low confidence). [Hervé Douville, France]	Considered but suggested wording not added. There is not space to add such technical details.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130197	29	40	29	41	This means to say flood potential will increase in areas where extreme precipitation will increase (i.e., currently a sentence fragment). [Trigg Talley, United States of America]	Considered. the sentence fragment is removed.
50353	29	41	29	41	The magnitude of extreme precipitation is projected to increase by approximately 7% per 1°C of global warming. 7% per 1 deg C - I thought there was a limit to the C-C relationship, meaning that 7% was theoretical and not usually realised. Also, how does this sit next to C 4.1 which states 1-3% per deg warming over land under RCP 8.5? It would be helpful to explain the reason behind this difference. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The sentence has been deleted.
9743	29	41	29	42	the sentence beginning "Flood potential in urban areas..." seems to have something missing. Doesn't read properly anyway [Jonathan Lynn, Switzerland]	Not applicable. The sentence has been deleted.
7703	29	41	29	42	The sentence "Flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels." lacks clarity. The following wording might add clarity: Flood potential in urban areas where extreme precipitation is projected to increase, will become higher, especially at high global warming levels. [Klaus Radunsky, Austria]	Not applicable. The sentence has been deleted.
27987	29	41	29	42	A part of the sentence is missing. [Eric Brun, France]	Editorial. In the revised SPM, all the sentence are grammatically correct.
15453	29	41	29	42	The sentence "Flood potential" seems to be incomplete. Please double check. [SAI MING LEE, China]	Not applicable. The sentence has been deleted.
23407	29	41	29	42	This could be connected to the CID pluvial floods (Ch12, Box SPM.3). [Anna Amelia Sörensson, Argentina]	Not applicable. The sentence has been deleted.
42615	29	41	29	42	It seems that a word or several words is/are missing in this sentence. [Sofie Schöld, Sweden]	Editorial. In the revised SPM, all the sentence are grammatically correct.
111485	29	41	29	42	There seems to be something missing from this last sentence. [James Renwick, New Zealand]	Editorial. In the revised SPM, all the sentence are grammatically correct.
34705	29	41	29	42	Urban areas are not areas that will have more extreme precipitation. Also, flooding potential can also increase in rural areas. Maybe the statement should be that urban areas are especially vulnerable in case of flooding, which is expected to increase? [Petra Seibert, Austria]	Not applicable. The sentence has been deleted.
130201	29	41	29	42	"Flood potential ..." is missing a verb. Is it meant that flood potential *will increase*? [Trigg Talley, United States of America]	Editorial. In the revised SPM, all the sentence are grammatically correct.
54685	29	41	29	42	The following sentence is missing words: "Flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels." For consideration: "Flood potential will increase ..." [Nancy Hamzawi, Canada]	Editorial. In the revised SPM, all the sentence are grammatically correct.
42267	29	41	29	43	C5.3 L41-43: "Flood potential ..." missing a verb. What changes? [Tina Christensen, Denmark]	Editorial. In the revised SPM, all the sentence are grammatically correct.
69405	29	41	29	43	The last sentence of the paragraph C.5.3 lacks a predicate. To address this editorial error, this sentence should be written as a description in line 51-52, page 7 of Chapter 11, such as; There is high confidence in an increase in flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels. [Kaoru Magosaki, Japan]	Not applicable. The sentence has been deleted.
87347	29	41	29	43	a verb seems missing in this sentence [Marcel Berk, Netherlands]	Editorial. In the revised SPM, all the sentence are grammatically correct.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25939	29	41	29	43	We think that the original drafting of the sentence in chapter 11, page 7, lines 51-52 is clearer: "There is high confidence in an increase in flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels" [Don Alfonso Pino Maeso, Spain]	Not applicable. The sentence has been deleted.
11621	29	41	29	43	This sentence looks incomplete. Missing verb? [Gerhard Krinner, France]	Editorial. In the revised SPM, all the sentence are grammatically correct.
41333	29	41	29	43	Please correct sentence, "Flood potential in urban areas with more extreme precipitation in the future is projected to increase..." or sth along those lines. [Alexander Nauels, Germany]	Not applicable. The sentence has been deleted.
131783	29	41	29	43	There is a verb missing (probably an "increase") - compare with chapter 11: "There is high confidence in an increase in flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels" [Hans Poertner and WGII TSU, Germany]	Editorial. In the revised SPM, all the sentence are grammatically correct.
81863	29	41	29	43	The sentence on flood potential in urban areas is incomplete. Suuggest use the wording from lines 18 and 19 on page 73 of Chapter 11 (section 11.5.5): "There is high confidence in an increase in flood potential in developed urban areas where extreme precipitation is projected to increase, especially at high global warming levels" [Dan Zwartz, New Zealand]	Not applicable. The sentence has been deleted.
130199	29	41		43	This is actually not a real sentence (it would be if "where extreme precipitation" were removed). [Trigg Talley, United States of America]	Editorial. In the revised SPM, all the sentence are grammatically correct.
77583	29	42	29	42	"Flood potential in urban areas where extreme precipitation is projected to increase, especially at high global warming levels". Requires rephrasing [Emer Griffin, Ireland]	Editorial. In the revised SPM, all the sentence are grammatically correct.
44847	29	42	29	42	What is the definition of "high"? Which warming level would be "low" (in the sense of impacts not being severe, etc)? If "especially" refers to "high", what applies for "lower" levels? [Markku Rummukainen, Sweden]	Not applicable. The sentence has been deleted.
29427	29	42	29	42	missing information such as: increased flood potential due to increased runoff subsequent to increased surface sealing. [Joachim Fallmann, Germany]	Not applicable. The sentence has been deleted.
131785	29	42	29	43	incomplete sentence [Hans Poertner and WGII TSU, Germany]	Not applicable. The sentence has been deleted.
77607	29		29		This section could refer to the regional synthesis change text box on page 34 [Emer Griffin, Ireland]	Noted. Text removed from here
90255	30	0	33	0	Table SPM2: The first column could be separated into phenomenon and trend columns. The 3rd to 5th rows from the bottom have no trends written, while all other phenomena have it next to them. [Bernadett Benko, Hungary]	Not applicable. Table removed.
7705	30	1	30	1	It is suggested to delete the qualifier "negative" in the following sentence: "The frequency and severity of prolonged negative anomalies in precipitation .." because anomalies can be positive (higher precipitation) or negative (less soil moisture). The cutrrrent wording is therefore confusing. Any such anomalies might have negative impacts on human and natural systems - however, this is outside the scope of WGI assessment. [Klaus Radunsky, Austria]	Taken into account. The term 'prolonged negative anomalies' no longer features in the SPM.
86137	30	1	30	1	Can "negative anomalies" be reworded to "drying trends" or something easier to understand like that? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
50357	30	1	30	1	negative anomalies in precipitation' is very technical language, could we say 'drying events' or similar? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131787	30	1	30	1	see comment above - again: prolonged negative anomalies (too technical for a SPM and the growing number of non-scientific readers) [Hans Poertner and WGII TSU, Germany]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
131789	30	1	30	1	prolonged negative anomalies - could this be rewritten to be less technical eg prolonged decreased from the long term average [Hans Poertner and WGII TSU, Germany]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
104215	30	1	30	2	The 1st sentence of C.5.4 should be more informative by clarifying what "some regions" means, and indicating the global trend. [Philippe Tulkens, Belgium]	Taken into account. This HS of the HS has been completely redrafted and refocused. Regional specification has been added where possible now in HS6, HS7 and HS11.
18733	30	1	30	2	"The frequency and severity of prolonged negative anomalies in precipitation, soil moisture, and streamflow are projected to increase in some regions". This sentence is vague by ending with "some regions" and hence is not a useful sentence at all. This vagueness associated with "some regions" can be seen in several places in the SPM. I beleive this comes from the chapter on extremes. Are these some regions located in the subtropical land regions? This may be checked in the model results and clarified in the chapter, TS and SPM. This vagueness should be avoided in the report. [Govindasamy Bala, India]	Taken into account. This HS of the HS has been completely redrafted and refocused. Regional specification has been added where possible now in HS6, HS7 and HS11.
81221	30	1	30	2	"The frequency and severity of prolonged negative anomalies in precipitation, soil moisture, and streamflow ... " It is better to say deficit instead of negative anomalies, otherwise there will be need to give more detail (base period ...) [Fatima Driouech, Morocco]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
5301	30	1	30	2	I suggest just saying "drought" instead of "prolonged negative anomalies in precipitation, soil moisture, and streamflow." Which one is more readable? [Daniel Murphy, United States of America]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
80153	30	1	30	9	The some regions (2nd line) is not enough specific in this context. Mentioning higher warming levels and 0.5 °C change cannot really fit each other, the 0.5 °C part could be omitted. Also, it is not clear what drier mean in this context (9th line): drier as annual precipitation are getting lower, or as summer ones or more droughts? [Lilian Fejes, Hungary]	Taken into account. This HS of the HS has been completely redrafted and refocused. Regional specification has been added where possible now in HS6, HS7 and HS11.
9531	30	1	30	10	Prolonged negative anomalies in preciptiation' should simply be 'prolonged/sustained declines in precipitation'. Also cross reference to relevant parts of chapter 8, section 8.4. [Joelle Joelle Gergis, Australia]	Taken into account. 'prolonged negative anomalies' no longer used in the revised SPM.
27989	30	2	30	2	Is it possible to specify which regions? [Eric Brun, France]	Taken into account. This HS of the HS has been completely redrafted and refocused. Regional specification has been added where possible now in HS6, HS7 and HS11.
87267	30	2	30	2	The word "streamflow" needs further explanation [Marcel Berk, Netherlands]	Rejected. The authors feel the term is suitably clear in the context of the sentence.
53507	30	2			"in some regions", please be more specific [Hervé Douville, France]	Taken into account. This HS of the HS has been completely redrafted and refocused. Regional specification has been added where possible now in HS6, HS7 and HS11.
25941	30	3	30	3	Please specify to what refers "variability", it seems it refers to "climate variability". [Don Alfonso Pino Maeso, Spain]	Taken into account. 'variability' no longer used in HS6.2
86139	30	3	30	3	"enhanced" – replace with "greater"? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. 'enhance' no longer used in HS6.2
42269	30	4			C5.4 L4: "Relative soil moisture deficits" and "relative precipitation deficits" are very technical terms [Tina Christensen, Denmark]	Taken into account. SPM was simplified and shortened. As a result, those terms no longer appear.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104217	30	5	30	5	Indicate what can be learned from the comparison of soil moisture deficits and rain deficits. [Philippe Tulkens, Belgium]	Not applicable. SPM was simplified and shortened. As a result, those terms no longer appear.
86141	30	5	30	5	What does “relative soil moisture deficits show stronger severity than projections of relative precipitation deficits” mean? [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. SPM was simplified and shortened. As a result, those terms no longer appear.
8171	30	5	30	5	Indicate what can be learned from the comparison of soil moisture deficits and rain deficits. [Frank Dentener, Italy]	Not applicable. SPM was simplified and shortened. As a result, those terms no longer appear.
53509	30	6	30	7	This is not a unique feature of droughts. May be just say that "The overall increase in drought severity and frequency is projected to be stronger at higher warming levels." Not sure there is enough evidence to add: "with a much stronger proportion of the world population experiencing droughts at +2° compared to +1.5°C global warming." [Hervé Douville, France]	Taken into account. HS6.2 now says 'Every additional half a degree of global warming causes statistically significant increases [...] the severity of droughts in some regions (high confidence).
130203	30	6	30	8	"These projections are strongly dependent..." needs clarification. To see a dependence of drought trends on warming, one would expect a range of warming levels. But the sentence fixes on a single level "as small as 0.5°C". [Trigg Talley, United States of America]	Taken into account. Reference to warming scenario removed in HS6.2.
27991	30	7	30	7	The main message is that 0.5°C is not a "small" change. Delete to avoid mis-interpretation. We propose: "even for change of 0.5°C in global warming". [Eric Brun, France]	Taken into account. HS6.4 says 'Every additional half a degree of global warming'
25943	30	9	30	10	Please provide an explanation for "transitional climate characteristics" [Don Alfonso Pino Maeso, Spain]	Taken into account. Term no longer used in revised SPM.
65629	30	12	30	13	Suggest changing to "Average peak tropical cyclone wind speeds and the proportion of Category 4-5 tropical cyclones are likely to increase globally..." for clarity. [Kushla Munro, Australia]	Taken into account. Text is rephrased.
130205	30	12	30	13	[CONFIDENCE] For tropical cyclones precipitation rate this should not state "will increase" and should not imply "very likely" or have "high confidence". For tropical cyclone precipitation rate this should be medium to high confidence at most, and if split wording is not available, then medium confidence. This projection has high level of agreement among existing modeling studies (although not as many studies have examined this as TC frequency change), the mechanistic understanding is strong, as is support for anthropogenic increases in total precipitable water, a key ingredient. What remains missing is a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). Recent detection/attribution studies for the Harvey event by Risser and Wehner and van Oldenbourg et al., while of high quality, analyze observed long-term changes in extreme precipitation in general, not tropical cyclone precipitation. Additionally, the Harvey event was mainly due to the multi-day stall-out of the hurricane in the region. [Trigg Talley, United States of America]	Considered but suggested wording not accepted. The assessment is supported by underlying chapter 11 assessment.
9533	30	12	30	17	Cross reference to chapter 8 needed, relevant parts of section 8.4. [Joelle Joelle Gergis, Australia]	Taken into account. Chapter 8 is referenced.
34995	30	12	30	17	The SOD predicts an increase in average tropical cyclone wind speeds, particularly category 4 and 5. Recent observations indicate a decline trend since the 1990s. Please see general comment #12 above. [Jim O'Brien, Ireland]	Rejected. The line is based on the underlying chapter 11 assessment.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
107495	30	12	30	17	The discussion here of projected changes in tropical cyclones is unbalanced. The damage done by hurricanes increases geometrically with wind speed. As a result, an increase in damages due to an increasing share of Cat 4-5 storms is not balance by a decrease in the overall frequency of all cyclones. [Hunter Cutting, United States of America]	Rejected. Damage (impact) due to hurricanes is beyond the scope of WGI report.
36237	30	12			Please use some preposition: "Average peak wind speeds of tropical cyclones and the...". Also move the 3rd sentence to follow this since they both speak of ferequency, then the 2nd sentence is about location. [Michael PRATHER, United States of America]	Taken into account. Text is rephrased.
69407	30	13	30	15	Future changes in the characteristic of tropical cyclones in the western North Pacific matters to this region. In this regard, it would be desirable to add an assessment of likelihood and confidence of projected pole-ward migration of average peak location of tropical cyclones in the region. The Technical Summary (page 51, line 6-8) and Chapter 11 (page 100, line 29-31) assess that this change has "medium confidence". [Kaoru Magosaki, Japan]	Considered, but the length constraint of the SPM limits the amount of details to be included.
69409	30	13	30	15	It would be better to add reasons why positions of tropical cyclone in the western North Pacific Ocean are projected to shift poleward. [Kaoru Magosaki, Japan]	Considered, but the length constraint of the SPM limits the amount of details to be included.
37653	30	13	30	16	No indication of confidence for two sentences in the middle of the paragraph? Or the bottom indication of (middle confidence) covers them? [Masahide Kimoto, Japan]	Taken into account. Text is rephrased with addition of confidence.
130207	30	13	30	16	There should be confidence levels attached to the poleward migration statement and frequency statement. [Trigg Talley, United States of America]	Not applicable, text is removed.
41253	30	14	30	14	"migrate poleward" - could this be quantified here? [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, text is removed.
50359	30	14	30	14	C5.5 mentions the North Pacific in relation to projected changes in tropical cyclone wind speed intensity, is there a reason why other oceans (Atlantic and Indian) are not mentioned too? If this is where the greatest change in this variable is seem it would be helpful to qualify this here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, text is removed.
117237	30	15	30	16	Does the sentence "global frequency of tropical cyclones....will decrease or remain unchanged" have a confidence qualifier? [Maisa Rojas, Chile]	Not applicable, text is removed.
25945	30	16	30	16	Please provide an explanation for "convective storms" [Don Alfonso Pino Maeso, Spain]	Not applicable. The text is removed.
80155	30	16	30	17	Besides the springtime severe convective storms, the more severe summertime ones should be mentioned too. While the early autumn ones should be in parallel with the springtime ones as studies suggest their increase (or appearance) as well. [Lilian Fejes, Hungary]	Not applicable, text is removed.
80157	30	19	30	19	It is not perfectly understood what the 1% probability extreme sea level events mean. Does it mean levels due to gale force winds or tsunami or the high-end model simulations? Naturally it increases as sea level rises but it is not clear what the 1% is in this context. [Lilian Fejes, Hungary]	Taken into account. This has been reworded as the frequency of extreme sea level events
50361	30	19	30	19	Suggested edit for clarification: 'The frequency of current 1% probability extreme high sea level events' (otherwise could be interpreted to mean extremes at either end) [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This has been reworded as once per century events becoming annual events.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131791	30	19	30	19	could this be rewritten to be more accessible eg extreme sea level events which currently occur once every 100 years will increase in occurrence? [Hans Poertner and WGII TSU, Germany]	Accepted.
8173	30	19	30	19	Suggest to phrase this in terms of return times as it is easier to understand-increasing from each 100 year to how much? [Frank Dentener, Italy]	Accepted.
81223	30	19	30	20	"The frequency of current 1% probability extreme sea level events will increase with continued global warming .." please specify to what level this frequency will increase. [Fatima Driouech, Morocco]	Taken into account. This has been reworded as once per century events becoming annual events.
69971	30	19	30	20	It is unclear what these sentences exactly mean. What is meaning of "relative sea level rise", that is, relative to what? I would like to suggest that it should be rephrased. [Young-Hwa BYUN, Republic of Korea]	Taken into account. This has been rephrased in HS9.3 to make clear that it is regional (rather than global mean) sea level rise.
65631	30	19	30	20	Suggest changing to "The frequency of current 1% probability extreme sea level events is very likely to increase to increase globally with global warming." This will make the text consistent with the subsequent statement that "relative sea level rise is very likely to continue ..." for consistency. [Kushla Munro, Australia]	Taken into account. This has been reworded as once per century events becoming annual events.
97379	30	19	30	22	Please quantify these changes. In addition, this sounds as if the level of warming does not matter. [Nicole Wilke, Germany]	Taken into account. This is clarified in HS9.3 demonstrating that this is the case at more locations with higher levels of global warming.
130209	30	19	30	22	The "very likely" likelihood statement attached to the relative sea level rise statement should be "virtually certain". It is possible that the authors only used "very likely" because this statement specifies no region and therefore is assumed to apply globally. It is "virtually certain" that relative sea level rise will continue through the 21st century for most coastal regions around the world. Recommend breaking this statement out regionally to say that it is virtually certain that most coastal regions will experience increased relative sea level rise. The regional qualifier should allow one to strengthen this likelihood statement. [Trigg Talley, United States of America]	Not applicable. Text does not appear in this form but global mean sea level rise appears as virtually certain.
42417	30	19	30	22	difficult to understand [Tina Christensen, Denmark]	Taken into account. This has been reworded as once per century events becoming annual events.
7707	30	19	30	23	The current wording might lead to the conclusion that sea level will rise along all coasts. However, there are regions, such as in the Arctic, that do not show increases in sea level due to faster upward moving of the continental plate (driven by loss of ice in Greenland). It is suggested to add wording such as "in most coasts worldwide".or "in many places local sea level change will be higher or lower than the global mean". [Klaus Radunsky, Austria]	Accepted. This is clarified by 'majority of coastlines' in HS9.3
42271	30	19			C5.6 L19: Does this apply to more than just the 1% events? Is there a reason for emphasizing these particular events? [Tina Christensen, Denmark]	Taken into account. This has been reworded as once per century events becoming annual events.
36239	30	19			This is a clearly written about how what are now 1% events will become X%. Please rewrite C.5.2 above as here. [Michael PRATHER, United States of America]	Taken into account. This has been reworded as once per century events becoming annual events.
27993	30	20	30	20	The meaning of the term "Relative sea level rise" is not clear. Please add "to local coasts" as in D5.2. [Eric Brun, France]	Taken into account. This has been rephrased in HS9.3 to make clear that it is regional (rather than global mean) sea level rise.
86477	30	24	20	20	This section is very difficult to understand, please consider rewriting. [Ala Taimar, Estonia]	Accepted. Reformulated.
80159	30	24	30	24	What does the similar sectors mean here? Please specify and make it more articulated. [Lilian Fejes, Hungary]	Noted. Clarification added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44849	30	24	30	24	The sentence "Concurrent extreme events... " is a bit vague. What does "similar sectors" mean? [Markku Rummukainen , Sweden]	Accepted. Clarification added.
131793	30	24	30	24	affecting similar sectors in different regions - what does this mean? [Hans Poertner and WGII TSU, Germany]	Noted. Clarification added.
87269	30	24	30	25	The message from this sentenc is not clear [Marcel Berk, Netherlands]	Accepted. Reformulated.
104219	30	24	30	29	The paragraph C5.7 could include information about the projection of humid heatwave, especially those at levels letal for human without protection. [Philippe Tulkens, Belgium]	Noted. Heatwave information included in reformulated SPM.
36241	30	24			sectors' is mentioned in the extremes section several time. I think that the reader will like this but want to know what sectors are being considered here, hopefully they can be listed in the Table SPM.2. [Michael PRATHER, United States of America]	Noted. Clarification added.
36243	30	24			C.5.7. The issue of concurrent extremes is very important. You have missed some literature where concurrent extremes are found in air quality and heat waves and in the duration thereof [Schnell, (2016) Effect of climate change on surface ozone over North America, Europe, and East Asia, Geophys. Res. Lett., 43, 3509–3518, doi:10.1002/2016GL068060; Schnell (2017), Co-occurrence of extremes in ozone, particulate matter, and temperature, PNAS, 114(11): 2854-2859, doi: 10.1073/pnas.1614453114]. I know that the Chapter 11 missed this work, but it is important and the govt's have always been interested in climate and air quality especially at the SPM level. [Michael PRATHER, United States of America]	Noted. Example provided but insufficient space for comprehensive details to be included.
44851	30	26	30	26	What is the meaning of "higher"? Higher than what? (If the dimension is one of time, then "continued warming" or suchlike would be a better term.) [Markku Rummukainen , Sweden]	Noted. Clarification added (higher than 2C).
117193	30	27	30	27	is "coastal flood risk" correct terminology? [Maisa Rojas, Chile]	Noted. Yes.
117239	30	27	30	27	is "flood risk" correct ? [Maisa Rojas, Chile]	Noted. Clarification added.
50363	30	28	30	28	Compound coastal flood risk (storm surge, extreme rainfall and/or river flow) will continue to increase in some regions' - suggest that 'particularly in coastal cities' is added to this statement. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Added to HS11.5
78973	30	32	33	0	SPM.2: this table is useful but too complex for an spm : it should be much simplified. Estimating physical changes wrt GMT is welcome, but may raise the issue of changing GMT definitions: is the GMT definition used here relevant to make a connection with impact analyses? Please consider this aspect and explain. [Martine Vanderstraeten, Belgium]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
42419	30	32	33	1	the mix og likelihood and certainty statements may give rise to confusion. The table holds a lot of information but should be condensed [Tina Christensen, Denmark]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
69411	30	32	33	2	Although the overview table is useful, some contents in SPM table 2 are already explained especially in paragraphs C5.1 to C5.7. If it is necessary to reduce the number of pages in SPM, the information in Table 2 and section C5 may be streamlined. [Kaoru Magosaki, Japan]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
69413	30	32	33	2	This table includes information regarding “Changes in tropical cyclone track”, which is not found in the corresponding table in TS, Table TS.8. Consistency between these two tables should be kept, and if changes in tropical cyclone track would not be worth to be included in the table of TS, this should not be included in the table in SPM too. [Kaoru Magosaki, Japan]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90207	30	32	33	2	Table SPM.2: While we think that these kind of tables give a nice overview of the projected impacts that are expected and thus complement the text in an rather easy accessible way, Table SPM.2 would gain in policy-relevance if also 2°C of global warming would be included, in order to clearly highlight the difference between 1,5°C and 2°C of global warming. [Georges Gehl, Luxembourg]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
19553	30	32	33	2	In column 2 of table SPM.2, top of page 31, there is a mysterious mention of a "box on global warming level". In the Severe Storms line, a "to" is missing before "extension". [philippe waldteufel, France]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
97381	30	32	33	2	Table SPM.2 provides a very useful synthesis of the projected changes in extremes. Please provide as much quantitative information as possible. Please add a third column on the changes of 2°C, the global warming level that is most relevant for the Paris Agreement. The text in the individual boxes should be shortened. Please avoid repeating the same statement by merging boxes across lines, thus emphasising the differential impacts. Please provide also information in the "AR5-temperature"-metrics. [Nicole Wilke, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
87191	30	32	33	2	We appreciate Table SPM.2. However, it could with benefit be distilled further. As it stands there it too much repetition of text and too little summation. The table headings/top row could also be repeated on each page for ease of reading (if indeed the final version spans several pages). [Oyvind Christophersen, Norway]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
86479	30	32	33	2	Table SPM.2 - this table is useful. There are overlaps with some of the statements in the sections above and these could be removed in order to shorten the text. Also in the table itself, when the two columns convey the same message then these could merged, that is done in some cases and not in others. [Ala Taimar, Estonia]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
86991	30	32	33	2	Table SPM.2 For the average reader who will not dwell on details and read the report from start to finish, such a summarising table is very useful. However, this table is said to show trends, but these trends are not easily available from the table. The information that stands out immediately, is the confidence for each cell. If the table is meant to communicate trends, these need to be shown more directly (e.g. visually). [Oyvind Christophersen, Norway]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
42273	30	32			Table SPM2: "Water logging" - unclear, technical term [Tina Christensen, Denmark]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
42275	30	32			Table SPM2: Why are right and left columns merged in "Servere convective storms" and "Increase in compound events"? [Tina Christensen, Denmark]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
42277	30	32			Table SPM2: "Increase in extreme sea levels": Why is the focus on the 1% annual event? [Tina Christensen, Denmark]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
78643	30	32			Table SPM.2 – as per table SPM.1 this is too long and complex. Keep details for TS and shorten here. Better still – could it be merged with table SPM1 to show observed and projected changes for a key subset of extremes? [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
2923	30	33	33	1	1.5 and 2.0C are provided better than 1.5 and 3.0C. [Zong Ci Zhao, China]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
77585	30	34	30	34	The "and/or" in the first column for some fields is confusing. It is unclear how this should be interpreted for the projections of columns 1 & 2. Does the "projected change" apply to both (and) or one (or) of the "Phenomenon"? [Emer Griffin, Ireland]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77587	30	34	30	34	Table SPM.2 Overall comment: Both confidence & likelihood metrics are used. Is it possible to use one metric throughout the table? [Emer Griffin, Ireland]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
86143	30	34	30	34	Please include a row on general drying trends, in addition to drought. This has substantial implications in drylands. – please also include statement on earlier, longer cyclone season, which was mentioned in bullets. This is also very important. The thought of having cyclones in spring (in S Indian ocean), when seasonal gale-force winds already buffet the coastline, is an important point of information for policy makers. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
117241	30	34	30	36	Is this table an update of something similar shown in the SR15? Can you argue why show 3C and not 2C. I would imagine many wanting to see 2C as well. Maybe supplementary material? In the TS? [Maisa Rojas, Chile]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
74081	30	34	30	38	The table has many entries that read exactly the same for 1.5°C and 3°C of warming. This does not reflect that the magnitude of change is clearly expected to be larger under 3°C, thus could be misunderstood that there is no difference between the scenarios. [Matthias Mengel, Germany]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
24481	30	34	33	0	The categories in Table SPM.2 should be improved to increase readability. The categories of phenomenon should be classified into two different layers. One explaining climate drivers (e.g. circulation, tropical cyclone, convective storms and etc.) and the other is CID (e.g. warmer days, cold days, precipitation and etc.). There are similar phenomena in the table several times (e.g. precipitation) and it is confusing. The categories of Table SPM.2 should be consistent with Table SPM.1 [Nobuhito Mori, Japan]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
7709	30	34	33	1	Table SPM.2: This table is very much appreciated. However, it is noted that the assessment differs sometimes not only with respect to the uncertainty of the statement but in more fundamental manner e.g. between warming of 1.5 and 3.0 degrees warming. E.g. Warmer and/or more frequent hot days and nights over most land areas whereas for many phenomena the structure of the assessment is the same. It is suggested to provide an explanatory note on any such discrepancies in order to enhance the understanding of the information and avoid misinterpretation. [Klaus Radunsky, Austria]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
104221	30	34	33	1	Table SPM 2 compares projected changes under +1.5°C and + 3°C scenarios to pre-industrial conditions. It would be more informative if the two scenarios were compared to each other. In many places the two columns make the same remark (eg, virtually certain on global scale). For a reader this could give the ill advised impression that efforts to keep below 1.5 °C are in vain as the consequences are the same as for 3°C. However, the differences can be huge, in particular taking into account the cascading feedback loops and tipping points which could still be avoided if we manage to keep global warming well below 2°C or even better below 1.5°C. It is also confusing while the changes sometimes cut across the two columns (applying to both, like for "severe convective storms"), whilst in other cases identical descriptions are provided separately for both. Hence this table should be either deleted or significantly restructured and reworked making clear the differences between an increase of 1.5°C and 3°C. [Philippe Tulkens, Belgium]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
37803	30	34	33	1	In some cases, the information in 1.5 C global warming and 3 C global warming are same or there is little difference. Such information does not make policymakers aware of the risks that vary by global warming level. We hope the content is clearly different. [Junhee Lee, Republic of Korea]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37805	30	34	33	1	For marine heatwave (MHW), it seems that the contents of 1.5 C and 3 C have been reversed. Please check this. [Junhee Lee, Republic of Korea]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
81865	30	34	33	1	A general comment on Table SPM.2 is that when the entries are the same for warming of +1.5°C and +3°C, then the cells could be merged as has been done for "severe convective storms" and "increase in compound events". This would improve the presentation. [Dan Zwartz, New Zealand]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
44853	30	34	33	2	May not be needed to explicitly state in cells of the table (in 1.5 column) that a change at some deg is larger than at some lower degree warming... Rather, in the 3 degree column, difference in outcome compared to 1.5 could be stated. [Markku Rummukainen, Sweden]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
44855	30	34	33	2	Suggest avoiding such technical detail on phenomena and mechanisms as CAPE. [Markku Rummukainen, Sweden]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
44857	30	34	33	2	Add clarity to what is meant by "under higher levels" of global warming (see entry on increase in compound events). [Markku Rummukainen, Sweden]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
89419	30	34	33	57	Table SPM.2: There is surprisingly much similarity / overlap between the projected changes for 1.5 and 3 degrees of warming - from the individual chapters, however, it seems there would be more pronounced differences between 1.5 and 3 degrees. I would recommend to check for consistency. (See also Schleussner et al. 2016, doi:10.5194/esd-7-327-2016) [Ricarda Winkelmann, Germany]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
93771	30	34	33		For consistency reasons, would it be possible to issue a likelihood statement for the larger decreases in warmer and/or fewer cold days and nights at 1.5°C compared to +1°C in most land regions? [Quentin Lejeune, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
93773	30	34	33		A statement on wildfires had been included in Table SPM.1. Would it be possible to do the same for Table SPM.2? [Quentin Lejeune, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
93775	30	34	33		Many rows of this table have the same content in both of the two rightmost columns. Would it be possible to merge the concerned cells in this case, as already done for severe convective storms and compound events? [Quentin Lejeune, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
44081	30	34			This table provides very useful information. In general, it would be appreciated if more information on projected changes under a SSP2-45/3degC pathway (similar to 2100 warming estimated from current NDCs) could be assessed and presented in the SPM. [Lamin Mai Touray, Gambia]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
86591	30	34			I don't have a strong opinion but what is the rationale for showing extremes at 1.5°C and 3°C? Other tables show dat for 1.5, 2, 3, and 4°C . [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
41335	30	34			This table, like Table SPM.1, provides very important and useful information. However, the plain table format and its huge size are a hurdle that will cause readers to move on. Would it be possible to transform the tables into sth visually more appealing? For example, use subcategories that can be distinguished via graphical symbols, similar to Figure SPM.7, and define colour code + symbols to substitute likelihood/confidence language. [Alexander Nauels, Germany]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
99993	30	34			This table is very useful. It would be great if other information (i.e. on mean climate) could also be presented in a 1.5°C vs. 3°C format. At times, however, this table is still a little bit inconclusive (e.g. for heat related extremes). [Caroline Eugene, Saint Lucia]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68815	30	34			Although this table is very useful, it is inconclusive. Information on heat related extremes should also be included. It would be great if other information (i.e. on mean climate) in a 1.5°C vs. 3°C format be presented. [Jeffers Cheryl , Saint Kitts and Nevis]	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
97383	30	35	30	36	The text refers to Table 11.1 the link in brackets to {Table 11.2}. Table 11.2 is correct here. [Nicole Wilke, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
27995	30	36	30	36	As regional informations are provided in table below (changes in tropical cyclone track), Table 11.1 must be quoted here. [Eric Brun, France]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
27997	30	36	30	36	Replace "TS.8" by "Figure 1.28" because this figure is the initial source for TS.8. [Eric Brun, France]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
27999	30	36	30	36	<p>The Table content is quite useful. However, we notice a significant redundancy with many messages from sub-section C5. We encourage the authors to reduce this redundancy in order to shorten the SPM length.</p> <p>Also, some informations do not appear in Table 11.2. This summary cannot be more complete than the table quoted. Thus, Table 11.2 should be completed.</p> <p>We also have specific comments:</p> <ul style="list-style-type: none"> - line 2 (Warmer and/or more frequent hot days and nights over most land areas) column 2: to which box does "Box on Global warming level" refer? - line 8 (Increases in floods and water logging) column 1: The term "water logging" is not common and likely to be misunderstood by policy-makers. - line 10 (Increase in precipitation associated with tropical cyclones (TC)) column 2: please add "(medium projection : 11%)" after the first statement. - line 10 (Increase in precipitation associated with tropical cyclones (TC)) column 3: please add "(medium projection : 21%)" after the first statement. - line 11 (Increase in mean tropical cyclone lifetime- maximum wind speed (intensity)) column 2: the information in Table 11.2 is not this one, it is : "Medium-to-high confidence for a 3.75% increase". - line 11 (Increase in mean tropical cyclone lifetime- maximum wind speed (intensity)) column 3: the information in Table 11.2 is not this one, it is : "Medium-to-high confidence for a 7.5% increase". - line 14 (Severe convective storms) column 1: There is no information about wind speed, tornadoes, hail, or lightning evolution (or non-evolution). [Eric Brun, France] 	Taken into account. Table SPM.2 removed from revised SPM, to shorten the SPM.
81905	30	38	30	38	It would be much clearer to say "compared to pre-industrial conditions unless specified" than "unless specified: compared to pre-industrial conditions" [Dan Zwartz, New Zealand]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
34547	30	38	30	38	The "unless specified" comment in the headers of table SPM.2 should be moved to the table caption. [Russell Vose, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
44905	30	38	33	1	For readability, please display the first line with the column headings on each new page [Markku Rummukainen , Sweden]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
50355	30	38	33	1	Table SPM.2 is very helpful. It would also be helpful to include a column on projected changes at 2°C. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
85891	30	38			The amount of space in C.5 and table SPM.2 devoted to extremes seems way out of proportion compared to the space allocated to all the other topics in the report. This is more or less a repeat of B.5 and table SPM.1. [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77711	30		33		Merging Table SPM1 (page 15) with Table SPM2 would help the comparison of past and future changes. [Emer Griffin, Ireland]	Not applicable. Those tables no longer features in the revised SPM, as we reduced the overall length of the SPM and tried to focus on the most policy relevant aspects.
17509	30				Table SPM.2 - this is helpful in that it provides a graphic illustration of the impacts at these two temperatures and the differences between them, but there is much duplication of the preceeding text (C.5). Do we need both? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Table removed from revised SPM
130211	31	1	31	1	The cell inthe first column that reads "Heavy precipitation events: increase in the frequency, intensity, and/or amount of heavy precipitations", "increase" should be capitalized to match the format of "Decrease" in the cell above. [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
42669	31	34			Table entry on 'heavy precipitation events' - is it consistent to have the caveat on 'low confidence' in the specifiied regions in the right box but not in the left box? [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
78661	31	37	31	39	lower right box: Shouldn't the first statement be removed (Very likely on global scale), given that the second statement is on the same topic, but more specific ("Very likely in most continents but low confidence ..."). [Heike Wex, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
41825	31		31		Table: Drought box: Here it is mentioned the projection of the atmospheric evaporative demand. I would homogenise with the text of the section. Here it is not mentioned drought probability (better drought frequency/intensity). [Sergio Vicente-Serrano, Spain]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
100347	31		31		Table SPM.2 - Line: Heavy precipittation events - Column: Projected changes at +3oC global warming - "Very likely in most continents but low confidence in Australasia, Central and South America". According to Tables 11. 4 until 11.9 we have low and medium confidence in many regions inside all continents. If this Table was done based in Figure SPM.8, it should be better to use in the second Column: Projected changes at + 4oC global warming. [Claudine Dereczynski, Brazil]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
81867	31				The entries in Table SPM.2 on "increase in marine heatwave frequency, intensity and duration" use the term "differential magnitudes in space". Please replace "space" with "spatial extent" which is the terminology used in Cross Chapter Box 9.1. This clarifies the meaning and avoids the use of jargon. [Dan Zwartz, New Zealand]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
24483	32	0	32	0	In the "Changes in frequency of tropical cyclones", there is description about the change in the global frequency. However, the latest GCM based projections indicate decrease, although only diagnostic methods project increase as discussed in 11.7.1.5 Projections. Use of "no change" need to revise based on careful discussion in the Chapter 9. The changes of TC frequency also depend on the region and therefore it is better to mention about regional dependence. [Nobuhito Mori, Japan]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
69415	32	0	33	0	In the Table SPM.2, only the columns for the rows "Severe convective storms" and "Increase in compound events (frequency, intensity)" are merged although other columns are still separated, though the nature of the contents are the same. [Kaoru Magosaki, Japan]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
82543	32	0			In the assessment on severe convective storms, for the spring increases, the corresponding assessment in Chapter 11 (P108 L2-4) refers only to the United States (the Chapter 11 wording could be clearer on this, but it is clear from the papers cited there) - this needs to be made clear in the SPM table too. [Blair Trewin, Australia]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
131795	32	0			Table SPM.2: I am not sure whether policymakers are familiar with the term "convective storms" [Hans Poertner and WGII TSU, Germany]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
130219	32	1	32	1	Why is the row for "severe convective storms" only two columns instead of three? [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
10211	32	1	32	1	mid-latitude storms? [Robert Kopp, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
130213	32	1			[CONFIDENCE] "High confidence in a projected increase of TC rain rates at the global scale." For both 1.5 and 3°C warming this should be medium-to-high confidence (as in the WMO TC/climate assessment, Knutson et al. 2019b). If this is not available due to IPCC rules, then medium confidence. This projection has high level of agreement among existing modeling studies (although not as many studies have examined this as TC frequency change), the mechanistic understanding is strong, as is support for anthropogenic increases in total precipitable water, a key ingredient. What remains missing is a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). Recent detection/attribution studies for the Harvey event by Risser and Wehner and van Oldenbourg et al., while of high quality, analyze observed long-term changes in extreme precipitation in general, not tropical cyclone precipitation. Additionally, the Harvey event was mainly due to the multi-day stall-out of the hurricane in the region. [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130215	32	1			[CONFIDENCE] "High confidence for a global increase for TC lifetime max windspeeds." This should be medium-to-high confidence (as in the WMO TC/climate assessment, Knutson et al. 2019b) for the statement that average peak TC wind speeds will increase globally with warming. If this is not available due to IPCC rules, then medium confidence for both. Rationale: There is good model agreement on an increase but evidence is still lacking for a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). One of the tricky things about future changes of mean intensity, or of the related change in the shape of the pdf of intensity, is that it depends not just on SST but also on details of the atmospheric profile of temperature change in the tropics. Both models and theory indicate this. For Emanuel potential intensity it's through outflow temperature changes, while in a high-resolution hurricane prediction model it's the amount of upper tropospheric warming relative to surface warming as discussed, for example, in Tuleya et al. (2016: Impact of upper tropospheric temperature anomalies and vertical wind shear on tropical cyclone evolution using an idealized version of the operational GFDL hurricane model. Journal of the Atmospheric Sciences, 73(10), DOI:10.1175/JAS-D-16-0045.1.). Unfortunately there is also uncertainty in precisely how tropical upper tropospheric temperature is going to evolve in the future, which contributes to uncertainty in the TC intensity projections, along with changes in subsurface ocean stratification, salinity, etc. [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130217	32	1			[CONFIDENCE] "High confidence for an increase in the proportion of TCs that reach the strongest (Category 4-5) levels." This should be medium-to-high confidence (as in the WMO TC/climate assessment, Knutson et al. 2019b) for the statement that average peak TC wind speeds will increase globally with warming. If this is not available due to IPCC rules, then medium confidence for both. Rationale: There is good model agreement on an increase but evidence is still lacking for a clear detection of an observed increase (i.e., that an observed increase is highly unusual compared to expected changes realizable from natural variability only). This is an essential part of a case for high confidence in a projection (that we don't just rely on models and theory for confidence, but that we actually see the change unambiguously in the data, and it's clearly distinguishable from natural variability). One of the tricky things about future changes of the shape of the pdf of intensity is that it depends not just on SST but also on details of the atmospheric profile of temperature change in the tropics. In a high-resolution hurricane prediction model, it's the amount of upper tropospheric warming relative to surface warming that is important for the closely related projected changes in TC intensity, as discussed, for example, in Tuleya et al. (2016: Impact of upper tropospheric temperature anomalies and vertical wind shear on tropical cyclone evolution using an idealized version of the operational GFDL hurricane model. Journal of the Atmospheric Sciences, 73(10), DOI:10.1175/JAS-D-16-0045.1.). Unfortunately there is also uncertainty in precisely how tropical upper tropospheric temperature is going to evolve in the future, which contributes to uncertainty in the TC intensity projections, along with changes in subsurface ocean stratification, salinity, etc. [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
130221	32	1			This is a stylistic comment. Why is it that "Severe Convective Storms" and "Increase in Compound Events" have entries that go across the 1.5 and 3°C warming columns, because they have the same words -- but this does not happen for other entries that also have the same words (e.g., most of the tropical cyclone entries). [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
108563	32	2	32	2	Water logging isn't defined anywhere in the SPM or in the glossary. It's a technical term and needs to be defined. [Jason Donev, Canada]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
108565	32	15	32	22	The talk about mean tropical cyclone lifetime and frequency of tropical cyclones. Elsewhere in the document it talks about this being at most medium confidence, but here it's listed as high confidence. Please check this for consistency. [Jason Donev, Canada]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
108567	32	28	32	29	It seems strange that the confidence for these two would be different. [Jason Donev, Canada]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
25947	32		32		As regards "Increase in mean tropical cyclone lifetime- maximum wind speed (Intensity)", we draw the attention to the the fact that both in TS. 8 (page 55) and Chapter 11, Table 11.2 page 24, indicate "Medium to high confidence for a 3.75% increase" and "Medium to high confidence for a 7.5% increase" for projected changes at +1.5° C and +3°C respectively. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
25949	32		32		As regards "Changes in frequency of tropical cyclones", we note that the second paragraph in both columns ("Medium confidence for decrease or no change in global frequency of all TCS") does not appear in either TS.8 or Chapter 11 , Table 11.2. [Don Alfonso Pino Maeso, Spain]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25951	32		32		As regards "Changes in frequency of tropical cyclones", we note that the corresponding paragraphs in the first and second columns of both TS.8 or and Chapter 11 , Table 11.2. state "Medium-to-high confidence for an increase in the proportion of TCs that reach the strongest (Category 4-5) levels" while in the SPM it is stated "High confidence for an increase in the proportion of TCs that reach the strongest (Category 4-5) levels" [Don Alfonso Pino Maeso, Spain]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
25953	32		32		It would be useful to have an explanation of "Convective Available Potential Energy". [Don Alfonso Pino Maeso, Spain]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
77683	32				Table SPM.2 different levels of certainty confidence laid out well. In extreme sea levels, this box could be above severe convective storms box? Severe c s and compound events 1.5 same as 3 oC. Table runs over 3 pgs, worth putting heading at top of each page? [Emer Griffin, Ireland]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
69417	33	0	33	0	The "Increase in compound events" in Table SPM.2, the "compound flooding at the coastal zone" would merit to be clearly defined for the policymakers. For instance, it could be formulated as "compound flooding (SLR, tide and surge) at the coastal zone". [Kaoru Magosaki, Japan]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
130223	33	1	33	1	Why is the row for "increase in compound effects (frequency, intensity)" only two columns instead of three? [Trigg Talley, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
10213	33	1	33	1	Why only medium confidence in the increase in humid heat waves? This seems thermodynamically as clear as the increase in heat waves. [Robert Kopp, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
36245	33	1			The table section above this line uses a different terminology than the bullet 'compound events' not 'concurrent' (latter is better). Also the air quality as one of the concurrent events is missing: definitely seen in heat waves & ozone, and un and droughts and aerosols(dust, Owens Lake). [Michael PRATHER, United States of America]	Not applicable. Table SPM.2 removed from revised SPM, to shorten the SPM.
65633	33	5	33	27	Suggest clarification. Currently the figure is difficult to understand due to the use of the terms "10-year" and "50-year". If the intent here is to convey that events that CURRENTLY (or HISTORICALLY) have 10-year and 50-year average return periods would occur more frequently under future warming, suggest labelling them as, e.g. 'Historical 10-year event' to improve readability. [Kushla Munro, Australia]	Considered. To improve readability and to make the figure less technical, the figure is completely re-designed as FGD Fig SPM.6 and it's caption is also rewritten.
32389	33	5	33	27	I find this figure and especially the caption rather hard to understand. What do the different dots for one SSP in A and C show? What are the different 30-year periods? Why are warming levels defined relative to the 1850-1990 average (and not 1850-1900)? I think it would be worth to revise the caption (and maybe the figure) to make its message easier to understand. [Clemens Schwingshackl, Norway]	Considered. To improve readability and to make the figure less technical, the figure is completely re-designed as FGD Fig SPM.6 and it's caption is also rewritten.
28129	33	5			Regarding Figure SPM.9: Would be nice to have the 1:1 lines plotted for both figures A & C. [Eric Brun, France]	Considered. To improve readability and to make the figure less technical, the figure is completely re-designed as FGD Fig SPM.6 and it's caption is also rewritten. In the new figure, the dots for different SSP are removed.
9745	33	7	33	7	Doesn't have that useful introductory sentence explaining the aim of the figure -- these are a great innovation so good to have them for all the figures [Jonathan Lynn, Switzerland]	Accepted. An introductory sentence on what the figure is added in the final version. Note the figure is renamed to Fig. SPM.6 in the final version.
36247	33	7			Good figure. [Michael PRATHER, United States of America]	Noted with thanks.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28001	33	14	33	15	We suggest to mention that "the 1°C warming climate" corresponds to the present climate. [Eric Brun, France]	Accepted. The figure is completely redesigned as Fig. SPM.6 in the final version. The 1C warming climate is explicit as "Present 1C" and the corresponding state of extremes are expressed as "NOW likely ..."
37655	33	15	33	15	Need a bit more friendly explanation of "average waiting time"? [Masahide Kimoto, Japan]	Considered. The figure is redesigned and the caption is rewritten. The definition of the event does not use "average waiting time" in the new caption. The event is defined as "on average once in ...".
130225	33	16	33	16	Recommend using "global ocean circulation patterns, such as AMOC" instead of only saying "AMOC" to better guide policymakers. Otherwise there is no context for what AMOC is/means/refers to. [Trigg Talley, United States of America]	Taken into account. Acronym no longer used. Instead, AMOC is spelled out in HS12.4 and potential consequences of a collapse are provided to better inform policy-makers.
81869	33	19	33	23	We note that the current Figure SPM.9 is a placeholder, and once the Figure is updated, it is possible that the caption will change. However, the explanation of the Figure offered in lines 19 to 23 is very helpful and would be even more helpful if this were at the beginning of the caption rather than the end. [Dan Zwartz, New Zealand]	Considered. The figure is redesigned and the caption is rewritten. In the revised caption, it was decided that there would not be space for such detailed explanation. But the new design also makes this aspect clear. In particular, the figure now has a headline "Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming" which is the most important to communicate.
42037	33	27	33	27	Caption of FIG SPM.9 is very long. A title and more informative names of axes etc. might help readability. [Juhani Damski, Finland]	Accepted. The figure now has a headline and figure caption is rewritten.
36249	33	28			End of C.5 and I have not seen anything about 'climatic impact drivers' - was hoping to find a definition through their usage. Take out of title of C.5? [Michael PRATHER, United States of America]	Not applicable. Headline statements do not have titles anymore.
80411	33	30	33	32	In other sections, this is mentioned as "low probability, high impact events" [Paola Arias, Colombia]	Taken into account: Use of language has been made consistent.
104223	33	30	33	37	Key message C6 states : The likelihood for unforeseen low-likelihood, high impact events related to extremes and tipping points is larger for global warming above 1.5 °C and there can be abrupt changes in the water and carbon cycle at the regional scale (low confidence). The tag 'low confidence' should be clarified and perhaps reassessed. Whilst there is limited evidence that would allow the quantification of the increase in the likelihood of such events, it can be stated with considerable confidence that they are more likely to emerge if the perturbation of the climate system is higher. It would also be highly policy-relevant to refer to the timing of such events, e.g. if they may occur sooner under a faster rate of warming. Policy makers should be aware that 'low-likelihood' events may be a lot closer than they may appear, as can be deduced from the evolution of the burning ember diagrams showing the reasons for concern in AR5, IPCC SRCCL and IPCC SROOC. [Philippe Tulkens, Belgium]	Accepted: The language and use of confidence statements have been revised.
86481	33	30	33	38	Low-likelihood, high-impact climate trajectories or events. There is no definition in the glossary. Please define using the IPCC language. [Ala Taimar, Estonia]	Accepted: Term has been added to the glossary
97385	33	30	34	19	Please include information about tipping points provided in subsection C.6.1 and C.6.5 in the headline statement C.6. The version here does not convey the high risks described in the subsections. [Nicole Wilke, Germany]	Rejected: The elaboration on specific tipping points has been removed from the revised section HS12.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104225	33	30	34	28	C6 This section is a welcome addition since tipping points/ thresholds are of constant interest to policymakers & stakeholders. However, it should be improved by providing explanations about the concrete consequences of the low-likelihood, high impact events that are presented. It would also be useful to comment on the extent to which the temperature thresholds of 1.5°C and 2°C are important in relation to low-likelihood, high-impact events. The idea of a 'hothouse earth'-style general tipping point is quite popular. It would therefore be useful for IPCC to comment on the degree to which such a notion is robust (how should one interpret the low confidence in the headline statement?). [Philippe Tulkens, Belgium]	Taken into account: We have tried to clarify this point in the first sentence of H12.3.
41051	33	30	34	28	There is a lot of "low" confidence language in this section. Granted this is low probability events, but could any high confidence statements that are policy relevant be made here? Also was there a reason ECS was not mentioned here, other than in relation to storylines? Also, permafrost not mentioned? [TSU WGI, France]	Accepted: The language and use of confidence statements have been revised.
90209	33	30	34	28	We think that section C.6 should be strongly reduced in order to only support the main message, which is "The likelihood for unforeseen low-likelihood, high-impact events related to extremes and tipping points is larger for global warming above 1.5°C and there can be abrupt changes in the water and carbon cycles at the regional scale (low confidence)." The references to storylines and other theoretical concepts is not something we would expect in the framework of a WG1 SPM and is undermining the robustness of the message communicated here and should thus be skipped. [Georges Gehl, Luxembourg]	Taken into account: The headline statement has been carefully revised and made more clear to emphasize why this section is important in the SPM.
130227	33	30	34	28	No mention of human decision issues and other low frequency, high impact events such as pandemics that could result in decreased fossil emissions. [Trigg Talley, United States of America]	Rejected: This was not part of the WG1 assessment.
7711	33	30			The inclusion of this subchapter is highly appreciated. The reason being that it is my understanding of good practice in risk management to be prepared for a worst case scenario, even it has a low likelihood. This becomes relevant as we move fast towards critical tipping points - given the significant inertia/slow processes related to international governance issues. [Klaus Radunsky, Austria]	Taken into account: Thank you very much for underlining the importance of this section. We tried to bring this reasoning more forward in the headline statement.
28005	33	32	33	32	The formulation "The likelihood for unforeseen low-likelihood" is unclear. [Eric Brun, France]	Accepted: Text removed in revised version.
50367	33	32	33	32	Suggested edit to clarify meaning: and the passing of climate tipping points...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: text has been removed
50369	33	32	33	32	Duplication of the word 'likelihood' here makes this somewhat confusing. Perhaps this could be amended to: 'The likelihood for unforeseen low-probability, high-impact events...'? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: text has been removed
38963	33	32	33	33	Can the tipping points be specified or examples given here? Your readers might have very different tipping points on their minds. [Maike Nicolai, Germany]	Taken into account: Tipping points (of which there are many) are comprehensively addressed in the underlying chapters. To keep the SPM concise, we refer not to any specific examples in the text.
11623	33	32	33	33	"The likelihood for unforeseen low-likelihood... events... is larger" - sounds a bit strange. [Gerhard Krinner, France]	Accepted: Text removed in revised version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86593	33	32	33	34	"The likelihood for high impact events and tipping points is larger above 1.5°C". Larger than what ? If you mean larger that below 1.5°C that's obvious, and you can say the same for every climate target. I would avoid such sentence as it gives the false impression that things will go very badly if/when we reach 1.5°C. As far as I know there is not well defined strong non linerarity appearing at 1.5°C. In fact section C6.2 and C6.3 contradicts such arm-waving statement. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: The text has been revised to reflect the underlying assessment more broadly in the first sentence of H12.3.
40817	33	32	33	34	SPM <-> TS: Could not find full support in the TS for this statement, with respect to 1.5 °C warming level. Instead found "There is low confidence regarding the global warming levels at which possible changes associated with global and regional tipping points (low-likelihood, high-impact events) related to extremes would occur, but these cannot be excluded, especially at high global warming levels (>3°C). {11.10} [TSU WGI, France]	Taken into account: The text has been revised to reflect the underlying assessment more broadly in the first sentence of H12.3.
54687	33	32	33	34	Headline C.6: Two comments: 1. The first part of the sentence says that for global warming >1.5C, the likelihood of "surprises" and low likelihood/high impact event increases (low confidence). Presumably it's the identification of 1.5C as a 'threshold' that leads to the low confidence. Therefore, it might be more useful to indicate with higher confidence that the likelihood of such events increases with increasing magnitude of global warming generally; 2. Similarly, is there low confidence in the potential for abrupt changes in carbon and water cycles generally, or does this depend on global warming level? As written, this is unclear, while para C.6.2 refers to abrupt changes in water and carbon cycles at high global warming levels. [Nancy Hamzawi, Canada]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.
54689	33	32	33	34	The wording in this sentence is problematic -- the likelihood of low-likelihood event has low confidence (!?). What is meant by 'unforeseen low-likelihood' event? [Nancy Hamzawi, Canada]	Accepted: Text removed in revised version.
89829	33	32	33	34	I suggest the potential for abrupt changes in atmosphere and/or ocean circulation at the regional scale should also be highlighted here. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: Abrupt changes are now mentioned in H12.2 and H12.4
34549	33	32	33	34	I do not think this sentence conveys a clear message about low-likelihood, high-impact events. It may be better to start with those for which confidence is high (e.g., volcanoes), and then simply say that confidence is low regarding other events such as deforestation in the Amazon and a potential collapse of the AMOC. [Russell Vose, United States of America]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.
28003	33	32	33	36	The logics behing the C6 headbox is very unclear. The 1st sentence mainly addresses mid or long-term events (global warming above 1.5°C) while the second sentence addresses the previsibilty of the short-term only. The last line should mention conclusions instead of only telling that we understand the effects without mentioning them. [Eric Brun, France]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.
28007	33	32	33	36	This summary mentions most "low-likelihood, high impacts" foreseen events. We suggest adding one sentence refering to the cryosphere ones. [Eric Brun, France]	Accepted: Text removed in revised version.
77069	33	32	33	37	This statement can be stronger based on the text included in this section [Emer Griffin, Ireland]	Taken into account: The headline statement has been carefully revised and made more clear to emphasize why this section is important in the SPM.
105603	33	32	33	37	Seems odd to have a low cofidence statement as a headline. Likewise a statement about irreducible uncertainties. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: The language and use of confidence statements have been revised.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50365	33	32	33	37	unforeseen low-likelihood, high-impact events': suggest that the word 'unforeseen' is removed, as none of the events in this section are unforeseen, and we do not have any evidence about the likelihood of events that are unforeseen. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text removed in revised version.
86993	33	32	33	37	This highlighted conclusion does not currently reflect the most policyrelevant findings from the bullets under this section. Especially findings from C.6.1 concerning very rare extreme temperature and precipitation events and changes that may materialize after 2100 could rather be the focus of this highlighted conclusion. [Oyvind Christophersen, Norway]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.
38615	33	32	33	37	"Following the scenarios it is very likely that global warming will exceed 1.5 degrees. Therefore there is high probability of passing tipping points. This will change to whole result of the report" [Aribert Peters, Germany]	Taken into account: The text has been revised to reflect the underlying assessment more broadly in the first sentence of H12.3.
105605	33	32	34	28	While not much can be said about likelihood, much can be said about impacts of AMOC collapse, ice-sheet destabilisation etc. Policy makers tend to want to know this (perhaps a reminder here about the existence of SROCC). [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Consequences of AMOC collapse are explained in HS12.4 and Fig SPM.8 d and e include a dotted line showing sea level rise that could result from ice sheet collapse.
130229	33	32	34	28	[RISK] Section C.6 deals with "low likelihood, high impact climate trajectories" and accurately depicts their difficult-to-predict nature and the increased likelihood of such events as global warming increases beyond 1.5°C. However, it seems important to impress upon policymakers the catastrophic potential of such events. Qualifying the opening statement of the summary as "low confidence" and devoting the rest of the summary to a "high confidence" statement about volcanic eruptions (a natural climate driver that causes temporary cooling) could lead policymakers to minimize or even ignore the risk of unpredicted, catastrophic "low likelihood" climate shifts. Thus it seems important to re-frame the pink box summary, roughly as follows (suggested additional language IN CAPITALS, suggested deletions in [brackets]): "The likelihood for unforeseen low-likelihood, high-impact events related to extremes and tipping points is larger for global warming above 1.5°C, AND THE EFFECTS OF SUCH EVENTS ON HUMAN CIVILIZATION AND GLOBAL ECOSYSTEMS CAN BE CATASTROPHIC. WHILE THERE IS LOW CONFIDENCE REGARDING SPECIFIC EVENTS, SUCH AS ICE SHEET DESTABILIZATION OR [and there can be] abrupt changes in the water and carbon cycles at the regional scale [low confidence], THE FREQUENCY OF CURRENTLY RARE EXTREMES IS VIRTUALLY CERTAIN TO RISE SHARPLY WITH DEGREE OF WARMING. Major volcanic eruptions represent a source of irreducible uncertainty [for near-term projections], YET THEIR [. The] short-lived climate effects [following eruptions] are [however] well understood (high confidence)." [Trigg Talley, United States of America]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50371	33	32	34	28	Thank you - this section on high impact events is really welcome. Suggest that C6 should also highlight that some high impact events can occur even in lower ECS runs due to natural variability – especially in the near term. The section currently does not highlight that we need to understand high impact events at all emission pathway levels - suggest it is more clearly stated that not all high impact events are associated with abrupt changes, for example - the enhanced Antarctic contribution to SLR example could be realised over centuries! A clearer statement on large uncertainty and low confidence would help this section. These uncertainties are higher for the probability of events but knowledge is clearer for impact/consequence of these events. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text removed in revised version.
111715	33	32			'Unforeseen' is not the right word here. They are foreseen events! I suggest "forseeable". [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text removed in revised version.
17511	33	32			Use of the word 'unforeseen' - given that IPCC is anticipating/predicting these events, they can't be said to be 'unforeseen'. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Text removed in revised version.
110999	33	32			Use of the word 'unforeseen' - if IPCC is anticipating/predicting these events, they can't be said to be 'unforeseen'. [Monica Dean, United States of America]	Accepted: Text removed in revised version.
36251	33	32			Really, if it is 'unforeseen' then you cannot name them, and cannot know that this unnamed scary event is 'larger'. Volcanic eruptions hardly fit in here, they are not low likelihood and you also say the climate effects are well understood. The purpose and headline of this section need to be decided upon and then rewritten. [Michael PRATHER, United States of America]	Accepted: Text removed in revised version.
44859	33	33	33	33	What is meant by "larger"? Larger than what/when? [Markku Rummukainen , Sweden]	Accepted: Text has been revised
53511	33	33	33	34	complete the sentence with "which can also arise from the interplay between climate change and internal climate variability."? [Hervé Douville, France]	Not applicable: Text has been removed/rewritten.
42279	33	33	33	34	C6 headline L33: What is meant by "carbon cycle at the regional scale"? Carbon cycle is traditionally a global phenomenon. [Tina Christensen, Denmark]	Accepted: Carbon cycle has been removed from the list of examples.
80161	33	33	33	36	The likelihood is larger for warming above 1.5 °C, but compared to what? Than now, than 2 or 1 °C? Also, mentioning major volcanic events might not be relevant here: they are not part of any long-term climate model simulations, and they are not reducible in any term projections (not just from near-term). See C.6.5 also. [Lilian Fejes, Hungary]	Taken into account: The text has been revised to reflect the underlying assessment related to warming levels more broadly in the first sentence of H12.3.
97387	33	33			How much larger? [Nicole Wilke, Germany]	Accepted: Text has been revised
42671	33	33			Is the wording 'warming above 1.5' justified by the evidence? This is unclear from the paragraphs that follow. This does look policy prescriptive. [Christopher Gordon, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: The text has been revised to reflect the underlying assessment more broadly in the first sentence of H12.3.
44907	33	34	33	34	A low confidence statement in the headline statement seems a bit strange. Would there be a relevant conclusion related to this, reminding on the increased risk of abrupt events, that is on a higher confidence level? [Markku Rummukainen , Sweden]	Accepted: The language and use of confidence statements have been revised.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104227	33	34	33	35	"Major volcanic eruptions represent a source of irreducible uncertainty for near-term projections": they are likely to be a source of irreducible uncertainty for any time-scale. Suggest deleting "near-term" or adding a qualifier (e.g.: "in particular for near-term"). [Philippe Tulkens, Belgium]	Taken into account. HS10.2 rephrased to clarify that aspect.
97389	33	34	33	35	"Major volcanic eruptions represent a source of irreducible uncertainty for near-term projections" Why only for near term projections? They have been influential on geological timescales too. Please delete "near term" [Nicole Wilke, Germany]	Taken into account. HS10.2 rephrased to clarify that aspect.
87349	33	34	33	36	volcanic eruptions are temporarily system disturbances unlike the structural system changes that is referred under tipping points. Does not seem to require such prominence here. Maybe more relevant to report that most Earth System models do not yet have the capability to assess the risks of low-likelihood, high-impact events, such as from carbon-climate feed backs. [Marcel Berk, Netherlands]	Taken into account. Volcanic eruptions and low-likelihood, high impact outcomes are no longer covered in the same headline statements. Volcanic eruptions are covered with natural variability in HS10.2 and Low likelihood, high impact outcomes are covered in HS12.
44861	33	34	33	36	The statement on major volcanic eruptions would not seem to be of such magnitude that it warrants a place in the headline statement. Such events do affect the trend, but events with near-term lifetime hardly in a major way in terms of magnitude or longevity. [Markku Rummukainen, Sweden]	Accepted. Volcanic eruptions no longer mentioned in the headline statement (HS10)
40833	33	34	33	36	SPM <-> TS: This comment relates to finding support for a particular SPM headline statement in the TS: SPM C.6 Headline statement: could not find support in the TS for "Major volcanic eruptions represent a source of irreducible uncertainty for near-term projections." and "The detection time of mitigation benefits for surface air temperature would therefore be about 25–30 years for the global mean and near the end of the century at regional scales (medium confidence)." [TSU WGI, France]	Taken into account. The SPM is now much better underpinned by the TS (and more specifically its summary boxes).
25955	33	35	33	35	It would be useful to have an explanation of "irreducible uncertainty". [Don Alfonso Pino Maeso, Spain]	Not applicable: Respective sentence has been removed.
87271	33	35	33	35	short lived -> short lasting [Marcel Berk, Netherlands]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.
41255	33	35	33	36	Maybe this statement is true for Pinatubo-sized eruptions (which we have been able to observe in detail), but Pinatubo was a long way from the biggest even in the past millennia. We may not understand non-linearities associated with much larger eruptions. Also the impact depends on frequency as well as size, and so we can't rule out a sustained impact. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The definition of the 'large' volcanic eruption is more than 1 Wm ⁻² , please see cross-chapter box 4.1. In addition, as a low-likelihood high impact outcome, HS12.5 also considers a series of very large volcanic eruptions.
77071	33	35	33	37	Surely it is the uncertainty about the occurrence of major volcanic eruptions which is the source of uncertainty. [Emer Griffin, Ireland]	Taken into account. HS10.2 rephrased to clarify that aspect.
101593	33	36			Change "are however well understood" to "are, however, well understood" [Knut Nadelhoffer, United States of America]	Taken into account: The headline statement has been revised to better reflect the purpose and content of this section.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54691	33	37	33	38	This is an example (albeit perhaps the most egregious) of a general problem in the SPM. The line-of-sight in these pink-shaded heading boxes contain pointers to many sections in many chapters. In this case, three sentences of text, containing only two instances of confidence language, are apparently based upon text in 17 sections, spanning 8 chapters of the underlying report (expanding out the references here would point the reader to hundreds of pages of underlying text!). This is not at all helpful to the reader seeking traceability of specific assessment statements. This must be addressed. Line-of-sight references must be *specific* to the actual assessment statements being made, and should direct the reader to a particular sub-section at least. They should not be generic references to multiple places in the report where the topic is touched upon. Otherwise they serve no useful purpose. [Nancy Hamzawi, Canada]	Taken into account: The headline statement and the line-of-sight references have been revised to reflect the new content of the headline statement.
116113	33		33		HS. First sentence, please be explicit on lines of evidence (Paleoclimate information? Model behaviour?). I would suggest to be careful in identifying a precise "threshold" above which the likelihood increases (at least, around 1.5°C/ or a range of levels of warming/ time horizons). [Valerie Masson-Delmotte, France]	Taken into account. Specific threshold no longer mentioned in HS12. Regarding the suggestion to mention the lines of evidence : this is not applicable, as the headline statements have been significantly shortened and simplified, and reflect multiple lines of evidence.
93777	34	1	34	3	The formulation "storylines can be built to investigate" is a bit awkward, please consider something like "Scenarios/storylines with high ECS and TCR values, contrasted but plausible large-scale circulation changes, or strong regional climate feedbacks have a low probability but a high impact as they would lead to high global warming." [Quentin Lejeune, Germany]	Not applicable, this bullet point was removed from the revised version.
25957	34	1	34	3	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Not applicable, this bullet point was removed from the revised version.
86483	34	1	34	4	The introduction of storylines is confusing here. IPCC assesses and synthesises the latest science and is not supposed to introduce storylines. It is not clear what they are and the uncertainties linked to these. [Ala Taimar, Estonia]	Not applicable, this bullet point was removed from the revised version.
42281	34	1	34	5	C6.1: Specify the meaning of storylines, and how they relate to scenarios. Explanation could be added box SPM1. C6.1 is generally hard to understand. [Tina Christensen, Denmark]	Not applicable, this bullet point was removed from the revised version.
44863	34	1	34	5	Suggest deletion of C6.1 as it is about methodology, not so much on results for the readers. Alternatively, the main idea could be moved to the headline statement as it is overarching for all of C6. [Markku Rummukainen, Sweden]	Not applicable, this bullet point was removed from the revised version.
9537	34	1	34	5	Note the use of 'low-probability high impact' is inconsistent with low likelihood high impact phrasing. Also suggest saying high climate sensitivity not high ECS and TCR in this summary statement so it does come across as jargon and dismissed by a non-expert reader. Also include a cross reference section 8.6 [Joelle Gergis, Australia]	Not applicable, this bullet point was removed from the revised version.
17513	34	1	34	5	This paragraph may be described as 'flowery' - language that perhaps doesn't sit well in an SPM. Can this be rewritten so that it is more specific? The use of the phraseology 'storylines' is one of the main issues here. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this bullet point was removed from the revised version.
97391	34	1	34	5	It remains unclear what "storylines" might be. Please explain. See our also concerns regarding this approach in our comment on "Storyline and narrative approaches" on the Entire Report. [Nicole Wilke, Germany]	Not applicable, this bullet point was removed from the revised version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23409	34	1	34	5	In this paragraph "storylines" is used in two different ways. What about changing the first part of the paragraph from "Storylines can be built to investigate low-probability high-impact scenarios" to "Storylines can be built to investigate low-probability high-impact events" (harmonizing with the Box SPM.1) and reemplacing the latter mention of Storylines: "Storylines leading to high global warming" with "Scenarios leading to high global warming". [Anna Amelia Sörensson, Argentina]	Not applicable, this bullet point was removed from the revised version.
97393	34	1	34	5	See our comments on low probability, high-impact scenarios on Box TS.2 please. [Nicole Wilke, Germany]	Not applicable, this bullet point was removed from the revised version.
108199	34	1	34	5	What is meant by “storylines” in this content? Is the author talking about building actual narratives, or this strictly related to data analysis. It’s unclear. [Anton Holland, Canada]	Not applicable, this bullet point was removed from the revised version.
86995	34	1	34	5	It is not clear what "storylines" refer to. Please consider a better explanation, [Oyvind Christophersen, Norway]	Not applicable, this bullet point was removed from the revised version.
131797	34	1	34	5	What are storylines? Who is the one developing them? Who is supposed to use them? [Hans Poertner and WGII TSU, Germany]	Not applicable, this bullet point was removed from the revised version.
87273	34	1	34	5	the term "storylines" is not well defined (see glossary page 47). We advise to rewrite or skip section C6.1 [Marcel Berk, Netherlands]	Not applicable, this bullet point was removed from the revised version.
104229	34	1	34	6	The storyline concept is not clearly introduced. In line 3 the word storyline seems to be interchanged with scenario. [Philippe Tulkens, Belgium]	Not applicable, this bullet point was removed from the revised version.
8175	34	1	34	6	The storyline concept is not clearly introduced. In line 3 the word storyline seems to be interchanged with scenario. Is this confusion needed? In my perception a story line is more an exploration of something that is unlikely to happen, but if it happens it may have big impacts=>risk analysis. [Frank Dentener, Italy]	Not applicable, this bullet point was removed from the revised version.
7713	34	1	34	28	This compilation of relevant tipping points is helpful. However, this information might only be noted by policymakers without any further consequences. It would be necessary to provide some more additional information, e.g. in a table, on the possible impacts related to relevant meteorological parameters, like temperature, precipitation, extreme events. Such information could be a basis for WGII to reflect on possible impacts and adaptation options to reduce climate change risks for such low-probability high-impact scenarios. [Klaus Radunsky, Austria]	Taken into account: Tipping points (of which there are many) are comprehensively addressed in the underlying chapters. To keep the SPM concise, we refer not to any specific examples in the text, but we make reference to relevance for risk assessment (topic of WGII).
5303	34	1	35	5	I suggest deleting this bullet. It is very generic. [Daniel Murphy, United States of America]	Unclear which bullet is referred to (wrong page/line numbers) but if this comment is about C6.1, then it is accepted, as the bullet has been removed.
36253	34	1			C.6.1 is confusing. Why 'contrasted' circulation changes? the 2nd sentence says almost nothing since 'large' is not defined nor contrasted with other scenarios. If you want to, just say that the 8.5 scenario will have the greatest potential among those investigated here for really extreme events? [Michael PRATHER, United States of America]	Not applicable, this bullet point was removed from the revised version.
36255	34	1			Do you define 'abrupt' anywhere? so as to undersand this sentence? need a footnote? [Michael PRATHER, United States of America]	Not applicable, this bullet point was removed from the revised version.
38965	34	2	34	2	If this sentence is complete and grammatically correct, I would like to ask what "contrasted but plausible large-scale circulation changes" are. Are the changes contradicting each other? Are they in contrast to something else - and what? [Maike Nicolai, Germany]	Not applicable, this bullet point was removed from the revised version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37807	34	2	34	2	ECS and TCR are rarely used, but they are abbreviated, making it difficult to understand what this sentence means. Instead of using abbreviations, write the original expression. [Junhee Lee, Republic of Korea]	Not applicable, this bullet point was removed from the revised version.
42421	34	2	34	2	Write out abbreviations [Tina Christensen, Denmark]	Not applicable, this bullet point was removed from the revised version.
130231	34	2	34	2	"contrasted"? Contrasted with what? [Trigg Talley, United States of America]	Not applicable, this bullet point was removed from the revised version.
131799	34	2	34	2	spell out acronyms [Hans Poertner and WGII TSU, Germany]	Not applicable, this bullet point was removed from the revised version.
44865	34	7	34	7	Please explain "high". For which levels of warming can such outcomes be excluded? [Markku Rummukainen, Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
53513	34	7	34	8	or even before due to the interplay between climate change and internal variability? [Hervé Douville, France]	noted
111679	34	7	34	8	Here is a good opportunity for a storyline to bring this sentence to life. What kind of things might these abrupt regional changes look like? (e.g. desertification or the opposite). [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
28009	34	7	34	8	This is an important point. And it should be emphasize somewhere that none of the model used include all the possible feedbacks and interactions between energy/Water and biogeochemical cycles. [Eric Brun, France]	noted. the paragraph has been revised to take this into account
111677	34	7	34	14	This is a useful paragraph but I think it's trying to cover too many things. Suggest split into water cycle and carbon cycle paragraphs. Some specific comments follow. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	taken into account. The treatment of carbon and water has been restructured in the FGD
81037	34	7	34	14	it is important to say that the in the event of any of this regional tipping points to realize, there is no implication that will trigger a global tipping point in the earth system, and ultimately in the climate system, which is our focus. Regional climate can indeed change substantial for some of the tipping points, for others not. Please make clear the link or possible lack of link between single tipping points and a tipping point that leads to a global change of direction. [canadell pep, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
130233	34	7	34	14	This key point begins by stating changes in both the water and carbon cycle, but then only discusses the carbon cycle. A separate bullet should be added for the water cycle with supporting sentences. [Trigg Talley, United States of America]	taken into account. water is now treated in HS7
107497	34	7	34	14	the deployment of "low confidence" language is confusing here. Reporting low confidence in statement that "Paleo records do not provide strong support for abrupts changes in the carbon cycle" is essentially reporting high uncertainty about a high-impact scenario. However, understand that takes unpacking by the reader, and that is not appropriate for a Summary for Policymakers. Similarly the discussion of the Amazon refers to a high-impact scenario with significant uncertainty. Language should be re-framed to make that clear for policy makers. [Hunter Cutting, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104231	34	7	34	15	Paleorecords while very interesting and informative may be of limited value, as the Anthropocene is significantly different, inter alia because of the speed of change and multitude of drivers. [Philippe Tulkens, Belgium]	taken into account. Sentence has been dropped because it is low confidence
9539	34	8	34	8	Paleo on its own is not a word. It is palaeoclimate records [Joelle Joelle Gergis, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50375	34	9	34	9	below 2 deg C' - what temps IS there evidence of potential abrupt carbon cycle change? It would be useful to know. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
23411	34	9	34	11	"Deforestation and global warming raise the probability that the Amazon will cross a tipping point into a dry state, although there is low confidence that such a change will occur before 2100." The large uncertainty here: is any of it related to scenario uncertainty? Could it be explicated if so? [Anna Amelia Sörensson, Argentina]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
90787	34	9	34	11	Are there other ecosystems that could also undergo such major changes? [José Romero, Switzerland]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54697	34	9	34	11	Given that there is a large range in projected warming by 2100 across scenarios, does this statement then apply across all levels of global warming projected out to 2100? If so, suggest replacing "before 2100" with "under projected global warming levels out to 2100". [Nancy Hamzawi, Canada]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
66499	34	9	34	11	I'd suggest reword to "although there is low confidence that such a change could occur before 2100" [Charles Koven, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
81929	34	9	34	14	It would be useful to indicate that the deforestation "resulting in a dry state" only relates to deforestation of the Amazon. [Dan Zwart, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
104233	34	10	34	10	Information about the tipping point of Amazon die-back is relevant and should be complemented, if possible, by information about the probability of die-back in other large tropical forest areas, including the Congo Basin and South-East Asia. [Philippe Tulkens, Belgium]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
20351	34	10	34	10	Are we talking here about the Amazon forest, the region, the river? [philippe waldteufel, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50381	34	10	34	10	Is it possible to briefly define the term 'dry state' means here in terms of a tipping point for the Amazon? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
29429	34	10	34	10	more information needed on the tipping point explanation with respect to the Amazon, with providing more details on the term 'dry state' [Joachim Fallmann, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
111681	34	10	34	11	there is low confidence that such a change will occur before 2100'. I didn't understand that. Low probability? Is there high confidence that the change will occur after 2100? Please clarify. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
28011	34	10	34	11	Does that mean that there is a higher confidence that it will occur after 2100? The sentence is not very clear. [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
11625	34	11	34	12	Irreversible permafrost carbon loss: indicate the time scale? (irreversible on centennial time scales) [Gerhard Krinner, France]	noted. irreversible changes are now treated as part of HS9
97395	34	11	34	12	This statement is inconsistent with the one in C.2.2 on the loss of CO2 per degree of warming. Please check. [Nicole Wilke, Germany]	noted. consistency checked.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
38617	34	11	34	20	"Carbon cycle feedbacks are very relevant. The fact, that they are poor represented in models seems to be a major failure of climate science. This should be mentioned more prominently in the report and need closer evaluation" [Aribert Peters, Germany]	noted. the revised paragraph puts uncertainty in carbon cycle feedbacks in perspective with differences in CO2 concentrations due to emission pathways. The revised text explains that the feedbacks become more uncertain with larger climate change, which is consistent with the underlying TS and Chapter 5
44867	34	12	34	12	Please explain "high". For which levels of warming can such outcomes be excluded? [Markku Rummukainen, Sweden]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
65635	34	12	34	12	Suggest using a time scale to qualify the term "irreversible". For example, suggest changing to: "Loss of permafrost carbon likely irreversible on centennial-to-millennial time scales ..." for clarity. [Kushla Munro, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25959	34	12	34	14	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
28013	34	12	34	14	This is really relevant and quite important regarding results presented in this report, as it means that impacts and consequences of global warming could be underestimated or at least strongly modified by these feedbacks. [Eric Brun, France]	noted. This paragraph has been revised and clearly puts uncertainty in carbon cycle feedbacks in perspective with differences in CO2 concentrations due to emission pathways. The revised text explains that the feedbacks become more uncertain with larger climate change, which is consistent with the underlying TS and Chapter 5
66439	34	12	34	14	I'd suggest reword to "Most Earth System Models still neglect or poorly represent some potentially important and/or abrupt carbon-climate feedbacks, such as those associated with permafrost, fires, droughts and vegetation mortality" [Charles Koven, United States of America]	noted. the paragraph has been revised to take this into account
44869	34	13	34	13	The word "neglect" signals oversight, which this is not really about. "Do not include" or suchlike would seem to be more appropriate. [Markku Rummukainen, Sweden]	noted. Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
9747	34	16	34	16	spell out AMOC [Jonathan Lynn, Switzerland]	accepted.
44871	34	16	34	16	Would "partial destabilization", or some other expression be more correct than "destabilization"? What would be the time scale for this (as is given for AMOC)? [Markku Rummukainen, Sweden]	Rejected. This text is consistent with the chapter discussions that expand on these terms
28015	34	16	34	16	As the previous appearance of AMOC is on page 13, "AMOC" should be replaced here by "Atlantic Meridional Overturning Circulation (AMOC)". [Eric Brun, France]	Noted. These changes will be made in final typesetting as appropriate.
35279	34	16	34	17	Dahl-Jensen (2013, Nature) found no evidence for a Greenland collapse in the Eemian, and that temperatures there were much warmer (6-8degC vs 2-3degC in summer) than previous estimates. Greenland can stand pretty much anything in the policy-relevant term, which is to around 2100. Ditto for Antarctica. Pollard's 2016 Antarctic submodel profoundly exaggerated recent warming in Antarctica-- by a factor of ten, so his rapid collapse model has no validity. [Patrick Michaels, United States of America]	Rejected. GrIS discussion has been rewritten to more closely align with the revised text, but not addressing abrupt change in the GrIS in the SPM.
54693	34	16	34	18	Recommend adding text here to explain further the potential for and implications of GIS destabilization. Previous text in the SPM identified thresholds for irreversible melting of the GIS. Clearly stating whether or not there is a potential for abrupt change (loss) of ice from the GIS would be helpful in the SPM. [Nancy Hamzawi, Canada]	Rejected. GrIS discussion has been rewritten to more closely align with the revised text, but not addressing abrupt change in the GrIS in the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
77073	34	16	34	19	Could this and other statements be links to warming increments and also commitment to global change? [Emer Griffin, Ireland]	Accepted. Spelled out and consequences explained in HS12.4
50377	34	16	34	19	C6.3: Is it possible to include a statement on the likelihood of GIS collapse this century? Earlier the SPM (C2.4) mentions irreversibility of long-term mass loss between 2 and 3C. Is it possible to say: 'Potential destabilisation of the Greenland Ice Sheet looks likely if emissions continue on their current trajectory'? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. GrIS discussion has been rewritten to more closely align with the revised text, but not addressing abrupt change in the GrIS in the SPM.
97397	34	16	34	22	Since these statements are from the SROCC, respective references should please be added. [Nicole Wilke, Germany]	Rejected. These statements are in chapter 9 which takes SROCC as the starting point.
53515	34	16	34	28	What about merging C6.3 and C6.4 and adding a last item about potential abrupt changes due to SRM initiation or termination (although SRM is mostly the topic of Section D)? [Hervé Douville, France]	Taken into account: C6.4 has been removed, ice sheet collapse is mentioned in new H12.2
81431	34	16			Not everyone will know what the AMOC is or indeed what its collapse means – this needs to be expanded to be understandable to the lay reader. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. There is an FAQ and glossary definition to explain.
41337	34	16			AMOC and ice sheet destabilisation should be covered separately. Potentially irreversible, non-linear ice sheet mass loss would nicely go together with SLR in the subsequent subsection C6.4. [Alexander Nauels, Germany]	Accepted. In later SPM versions this combination is not carried through except in the overall headline statement
36257	34	16			Drop 'potential', all of what is discussed here is only potential. Also with this bullet, does it matter that it is 'abrupt', within 10 years, or takes 50 years? Either way the consequences of the AMOC for Europe are severe. [Michael PRATHER, United States of America]	Accepted. Sentence edited.
36259	34	16			Looking at Box SPM.3 Fig1, I do not see anything separating current vs future. The confidence language is noted with the outlines on the pie pieces. [Michael PRATHER, United States of America]	Accepted. Figure redrawn.
41257	34	17	34	17	"unlikely" - if this is using IPCC calibrated language, does this mean there is a up to a 33% chance of AMOC collapse? If so, it sounds as if it is not being ruled out even before 2100, although the tone of the sentence implies this. So I got a mixed, and worrying, message from this sentence. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This framing of the likelihood has been removed.
86145	34	17	34	17	What will be the impact / implication of an AMOC collapse? Please also spell out in more detail the implication of ice sheet collapse, beyond the obvious rise in sea level. [Debra Roberts and the Durban WGII TSU, South Africa]	Rejected. There is an FAQ and glossary definition and chapter text in Chps 4, 9 to explain these consequences.
104235	34	17	34	18	Delete "after 2100", or adjust the uncertainty language related to a collapse during the 21st century. [Philippe Tulkens, Belgium]	Not applicable. This sentence has been rewritten.
111683	34	17	34	18	Interesting that AMOC collapse is now only assessed as 'unlikely'. It was 'very unlikely' in SROCCC (and AR5). I think this deserves further comment here. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. AMOC assessment revised in HS12.4
111685	34	17	34	18	The sentence is a bit strange, as it doesn't rule out a collapse during the 21st Century, then says that a collapse can't be ruled out after 2100. Suggest clarify. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This sentence has been rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89831	34	17	34	18	unlikely means only 66% probability, so the assessment is already of a 33% likelihood of abrupt collapse in the 21st century. The phrase "cannot be ruled out" is not defined in IPCC calibrated language but it sounds much less than a 33% likelihood, which implies abrupt change is less likely after 2100! Please correct. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. This framing of the likelihood has been removed.
104237	34	18	34	18	If the uncertainty assessment is unlike for the 21st century- it implies that also in the 21st century it can not be ruled out, and the 22nd century statement doesn't make sense. Statement needs to be corroborated. [Philippe Tulkens, Belgium]	Not applicable. This framing of the likelihood has been removed.
8177	34	18	34	18	If the uncertainty assessment is unlike for the 21st century- it implies that also in the 21st century it can not be ruled out, and the 22nd century statement doesn't make sense. Statement needs to be corroborated. [Frank Dentener, Italy]	Not applicable. This framing of the likelihood has been removed.
37657	34	21	34	21	Is it OK to use "deep" uncertainty? [Masahide Kimoto, Japan]	Taken into account. The SPM now refer to low likelihood, high impact outcomes and deep uncertainty associated with ice sheets is more explicitly explained in HS9.2
104239	34	21	34	21	If there is 'deep uncertainty' on Antarctic melting, it is not immediately obvious why this would apply only for high GHG emission scenarios. Also indicate timescales for these statements. [Philippe Tulkens, Belgium]	Taken into account. This is clearer now in figure SPM8 labelling. The risk of widespread loss of the Antarctic ice sheet at higher temperatures is discussed in chapter 9.
8179	34	21	34	21	If there is 'deep uncertainty' on Antarctic melting, it is not immediately obvious why this would apply only for high GHG emission scenarios. Also indicate timescales for these statements. [Frank Dentener, Italy]	Taken into account. Text has been moved to HS9.2. The evidence agrees that risk of widespread loss of Antarctic ice sheet is greater at higher warming levels (see chapter 9)
69419	34	21	34	22	Removing C.6.4 is suggested, as there is an overlapped sentence in C2.4. [Kaoru Magosaki, Japan]	Accepted. The Antarctic ice sheet collapse is now referred to in HS9.2
104241	34	21	34	22	C6.4 Please contextualise this Antarctic GMSL contribution some more. What does it mean for how readers should interpret the likely upper bound estimates for GMSL in the report? [Philippe Tulkens, Belgium]	Taken into account. This is now visualised in figure SPM.8
38967	34	21	34	22	Can information about low emission scenarios be added here and can the reason for the deep uncertainty be explained? [Maike Nicolai, Germany]	Accepted. See figure SPM.8 and HS9.2
9541	34	21	34	22	Does this statement really warrant a feature in the SPM? If so elaborate a little as there is not enough information to understand what the implications are etc [Joelle Joelle Gergis, Australia]	Taken into account. This is now combined with HS9 in HS9.2
111687	34	21	34	22	This is a place where storylines are desperately needed. 'Deep uncertainty' does not mean 'we know nothing useful'. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This is now moved to HS9.2 with further explanation
25961	34	21	34	22	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
11627	34	21	34	22	Deep uncertainty, OK, but we do know that it's more likely to be a strong positive than a strong negative contribution to sea level, don't we? Maybe we should define what "deep uncertainty" means (in the "core concepts" box? Or is it enough to define it in the glossary?) [Gerhard Krinner, France]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d
28017	34	21	34	22	The sentence should at least precise if the contribution is positive or negative. [Eric Brun, France]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97399	34	21	34	22	Is this deep uncertainty independent on the level of warming / the scenario? [Nicole Wilke, Germany]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d. As described in chapter 9, the uncertainty is particularly related to higher warming scenarios.
54695	34	21	34	22	Is this deep uncertainty about Antarctic contributions to GMSL rise under high emission scenarios true for projections this century or only in the longer term? Also, since this section is about abrupt changes and low probability/high impact events, it would be helpful to link the issue of deep uncertainty in Antarctic contributions to GMSL to issues of marine ice sheet and ice cliff instabilities. [Nancy Hamzawi, Canada]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d
54699	34	21	34	22	This sentence (and others like it) are not particularly helpful in a SPM. Merely stating that there is 'deep uncertainty' does not convey any actionable information and would not aid in the decision- or policy-making process. Also, the line of sight to Table 4.9 is inappropriate (or perhaps incorrect). That table does not provide support for this sentence. [Nancy Hamzawi, Canada]	Accepted. This text is now clarified in HS9.2 and visualised in figure SPM8d
50373	34	21	34	22	The uncertainty in Antarctic contribution to GMSL is covered in other sections. Given this section is about events relating to extremes, and tipping points, it might be more helpful to talk about what would lead to West Antarctic Ice sheet Collapse. For example, text from section 9.4 that is relevant might include "WAIS due to grounding line retreat in the Amundsen Sea Embayment (ASE), as suggested by some modelling studies is presently close to being underway." (section 9.4.2.1) and "RCP8.5 simulations [...] trigger a long-term retreat of the WAIS, with mass loss accelerating late in the 21st century and rising steadily over the next several centuries without levelling off. Projections for RCP2.6 suggest that this emissions scenario might avoid full collapse of the WAIS" (section 9.4.2.2) [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This text is now clarified in HS9.2 and visualised in figure SPM8d
86485	34	21	34	22	What is 'deep uncertainty'? It is not defined. Please use IPCC uncertainty language. [Ala Taimar, Estonia]	Accepted. This text is now clarified in HS9.2 which explains the low confidence rather than using deep uncertainty.
10215	34	21	34	22	This comment about deep uncertainty could use expansion, based on the corresponding Box in ch. 9. [Robert Kopp, United States of America]	Accepted. This text is now clarified in HS9.2 and visualised in figure SPM8d
131997	34	21		22	This bullet essentially says that the Antarctic may have no share in causing sea level rise...? I assume this is not what the authors wish to say but the uncertainty is about its quantitative contribution... This needs to be made clear. [Hans Poertner and WGII TSU, Germany]	Accepted. This text is now clarified in HS9.2 and visualised in figure SPM8d
32887	34	21			Can more details be given on high impact, low probability storyline associated with Antarctic ice sheet collapse as well as the probability of higher levels of projected sea level rise due to increased basal melt of the Antarctic ice shelves? See Box 9.3 [Helene Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d
41339	34	21			The AIS SLR contribution is a very important, highly uncertain, but potentially very high impact component. One sentence does not do this issue justice. It would be very helpful to elaborate on plausible magnitudes and timescales here. [Alexander Nauels, Germany]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
99995	34	21			The question of deep uncertainty is again highlighted and it's specific reason. Even if risks cannot be attributed to warming levels or scenarios, they should be presented in a transparent and accessible manner. At least it should be mentioned, how much SLR Antarctica could possibly contribute. [Caroline Eugene, Saint Lucia]	Taken into account. This is now moved to HS9.2 where the uncertainty is explained and visualised in figure SPM8.d
68817	34	21			Please be more explicit with the concept of 'deep uncertainty'. Even if risks cannot be attributed to warming levels or scenarios, they should be presented in a transparent and accessible manner. It would be worthy to include how much SLR Antarctica could possibly contribute. [Jeffers Cheryl , Saint Kitts and Nevis]	Accepted. This text is now clarified in HS9.2 and visualised in figure SPM8d
41259	34	24	34	24	I don't know what "major volcanic eruption" means here - "major" would mean different things if I took a 30, 200 or 20,000 year perspective. Also as noted in my comment at 33:35, it is not only the size but the frequency that matters. These sentences conflate, to some extent, the effect of a single and multiple eruptions, by sometimes using the singular and sometimes the plural. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The intensity of volcanic eruption considered in this statement has been specified in footnote 38 in the final, approved version (C1.4) . "Major" refers to eruptions more negative than -1 W/m ² based on a 2500yr reconstruction which occur on average twice per century". Issues related to frequency/sequence of eruptions is also addressed in C3.5 under the low-likelihood-high-impact framework.
67677	34	24	34	24	don't volcanic eruptions represent large uncertainty for any length climate projections? (not just short-term)? [Karen Rosenlof, United States of America]	Noted. The sentence has been removed as volcanic eruptions are indeed a source of uncertainty for all timescales. The effect for each timescale has been accordingly specified in HS10.2 for near-term and in HS12.5 under low-likelihood-high-impact framework for long-term.
28019	34	24	34	24	It would be clearer to say that major volcanic eruptions are the sole natural source of uncertainty which might dampen the current rate of warming in the near-term future. [Eric Brun, France]	Taken into account. A sentence has been added (HS10.2) accordingly: "If it occurs in the near term, this could delay the emergence of human influence on some regional changes"
97401	34	24	34	24	Please explain why major volcanic eruptions have no relevant influence on the climate on the long-term. [Nicole Wilke, Germany]	Noted. The original sentence was misleading mixing the intrinsic uncertainty related to volcanic eruption and the weight of the volcanic effect as a function of the term and therefore global warming level. The sentence has been revised accordingly.
104243	34	24	34	28	Volcanic eruptions are included, but possibly not the ones that reach the stratosphere. [Philippe Tulkens, Belgium]	Noted. The intensity of volcanic eruption considered in this statement has been specified in footnote 38 in the final (approved) SPM (C1.4) . "Major" refers to eruptions more negative than -1 W/m ² which statistically occurs twice based on a 2500 yr reconstruction. Those are the ones that usually reaches the stratosphere.
38969	34	24	34	28	Can you give an estimate of how likely it is that a major volcanic eruption that is able to affect the climate might occur in the near-term and the long-term? At the moment this sounds as if from time to time volcanic eruptions have an influence (with e.g. geologists having a different perception of "from time to time" than policymakers or other stakeholders). [Maike Nicolai, Germany]	Taken into account. The intensity of volcanic eruption considered in this statement has been specified in footnote 38 in the final, approved version (C1.4) . "Major" refers to eruptions more negative than -1 W/m ² based on a 2500yr reconstruction which occur on average twice per century". Issues related to frequency/sequence of eruptions is also addressed in C3.5 under the low-likelihood-high-impact framework.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111689	34	24	34	28	This is nearly a useful storyline. Could you quantify potential effects? [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Effects of volcanic eruptions have been assessed on temperature, land precip, monsoon, extremes and CIDs.
31581	34	24	34	28	Chap 9 could be used here. Happy to discuss. « the ocean integrates the radiative cooling in its subsurface, typically in the upper 500 m and deliver it back to the surface over decadal periods, extending the global ocean heat content response and associated impact of thermosteric height well beyond the eruption time scale » [Jean-Baptiste SALLEE, France]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements.
8181	34	24	34	28	Volcanic eruptions are included, but possibly not the ones that reach the stratosphere. [Frank Dentener, Italy]	Noted. The intensity of volcanic eruption considered in this statement has been specified in footnote 38 in the final (approved) SPM (C1.4) . "Major" refers to eruptions more negative than -1 W/m2 which statistically occurs twice based on a 2500 yr reconstruction. Those are the ones that usually reaches the stratosphere.
36261	34	24			C.6.5. really does not belong in this section - it should go into the scenario main section and state exactly what it does here. Its point is that the scenario projections are have an uncertainty due to volcanoes. What about solar cycle? [Michael PRATHER, United States of America]	Noted. The original sentence was misleading mixing the intrinsic uncertainty related to volcanic eruption and the weight of the volcanic effect as a function of the term and therefore global warming level. The sentence has been revised accordingly to better fit to this section by focussing on the weight with respect to projected human influence and not on uncertainties. Volcanoes are now addressed through "if statements", or in other words as a storyline. HS12.5 has been added accordingly to assess volcanic effect in a low-likelihood-high-impact framework.
44873	34	26	34	26	It would be very useful to give an idea of the size of such "surface cooling" here, so as to provide perspective to greenhouse warming. [Markku Rummukainen , Sweden]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements because it clearly depends on the size of the eruption. That said, the surface cooling has been put into perspective with human influence at near-term (HS10.3) and with long-term changes in HS12.5 under the low-likelihood high impact framework.
50379	34	26	34	26	a few years' - if would be helpful to quantify this, could you give a range? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements because it clearly depends on the size of the eruption. That said, the surface cooling has been put into perspective with human influence at near-term (HS10.3) and with long-term changes in HS12.5 under the low-likelihood high impact framework.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97403	34	30			We encourage the authors to consider including a new para (possibly "C.6.6"), and move up the following sentence from the TS, p.8, lines 54-57, also to the level of the SPM: "Climate change is a direct driver that is increasingly exacerbating the impact of other drivers on nature and human well-being." If our proposal to include the following sentence in Ch 1, p. 14, lines 33-34 is accepted, then it could be included under a new "C.6.6" in the SPM as well: "A synthesis of many studies estimates that the fraction of species at risk of climate-related extinction is 5 per cent at 2°C warming and rises to 16 per cent at 4.3°C warming." [Nicole Wilke, Germany]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statements. In addition, this type of statement is more appropriate for WGII SRM than WGI one.
87193	34	31	38	16	General comment to Box SPM.3. In its current format, and where we are with respect to process in the Sixth Assessment cycle it is somewhat challenging to digest all the important messages that are associated with this Box, and especially with regards to information that interlinks between WGI and WGII and where such information most naturally belongs. In its current form we believe that the Box is built in a way that fits better in the WGII report. However, we agree that there are certainly a need to include more basic regional climate information from WGI than what was provided in AR5 WGI SPM. We are also finding the current selection of climate impact drivers to be somewhat overstepping into the WGII realm of impacts and vulnerability, e.g. "River flood", "pluvial flood", "landslide", "snow avalanche", Coastal flood" and "coastal erosion". We are also questioning how comparable these findings are, both within, but especially across the different regions. By setting it up the way it is done, both in the Table and Figure one gets the impression that information from the different regions are comparable and given equal weight. If this is the case it might be okay, but that seems, in our view, to be very challenging to assess for the authors and just as importantly challenging to understand for policymakers without having access to appropriate and thorough information about e.g. natural and societal vulnerability that we would expect in the WGII SPM. We think that this Box needs some rethinking, especially based on what is appropriate to come out of a WGI SPM. And the authors could focus more on setting up a regional focus that establishes a scientific knowledge basis on the more traditional WGI parameters, and on a regional basis, that can be useful for, while at the same time not overstepping into WGII findings. [Oyvind Christophersen, Norway]	Accepted/Noted. Box has been deleted. CIDs were chosen in part following consultation with WGII but their inclusion was based on the assessment of WGI authors that they were generally relevant to impact and risk assessment and thus defensible as relevant for WGI to assess.
7715	34	31	38	18	It is strongly recommended NOT to include BOX SPM.3 in the SPM of WGI. The reason being, that the selection and the regional assessment of the CIDs addressed in Box SBM.3 has been shaped by the interaction with and feedback from the WGII assessment of climate change impacts, adaptation, risk and solutions. However, such material might not have been approved prior to the approval of the SPM of WGI and this could introduce a procedural problem for the approval and adoption of the whole WG I contribution to AR6. Furthermore the current SPM is much too long and deferring these 4 pages to the synthesis report could help to reduce the length of this SPM. [Klaus Radunsky, Austria]	Accepted/Noted. Box has been deleted. CIDs were chosen in part following consultation with WGII but their inclusion was based on the assessment of WGI authors that they were generally relevant to impact and risk assessment and thus defensible as relevant for WGI to assess.
44875	34	31	38	18	The Box might be more appropriate to include in section D than here in the SPM. [Markku Rummukainen, Sweden]	Not applicable. The box has been removed.
90211	34	31	38	18	Box SPM.3 should be modified in the sense that it should also include regional information relevant for mitigation as highlighted in section D. [Georges Gehl, Luxembourg]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78975	34	31	38	18	Box SPM 3: too long and complex, it could probably be simplified and improved. [Martine Vanderstraeten, Belgium]	Accepted. The box has been removed.
132281	34	31	38	18	Box SPM3. Chapter 11 LAs and CLAs did not have enough time to comment on this box. It will need to be carefully revised for the FGD. [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
86487	34	31	38	18	Box SPM3 Please delete this box, both the table and the figure here are difficult to understand. This belongs to the technical summary. Here, a couple paragraphs summarising regional differences and a reference to TS should be sufficient. [Ala Taimar, Estonia]	Accepted. The box has been removed.
130235	34	31			It is noted that everything associated with this box and the associated table includes (though is not limited to) raw model output for its results. Does that include the output from models whose warming is thought not to be representative of the preferred GSAT predictions? This should not be the case. A statement should be included to clarify whether or not model output was excluded in Box SPM.3 and and Table SPM.1. [Trigg Talley, United States of America]	Not applicable. The box has been removed.
131801	34	31			would climate variables or just climate be a better term here? Hether or not an impact occurs will be assessed in WGII [Hans Poertner and WGII TSU, Germany]	Noted. The CID concept also allows WGI to very clearly show the many and diverse ways in which climate change is and will continue to have impacts without straying into the WGII territory of assessing these to be negative, positive or neutral.
112169	34	32	38	16	Wow - this is indeed an epic Table, packed full of details, which rewards the stubborn and persistent reader after about four or five re-reads! I think this is potentially a valuable contribution, and i prefer the individual CIDs shown here than the composite shown on the Map in SPM3, Fig 1. However, it is incredibly difficult to interpret for the layperson, which suggests to me that a worked example (or two) for single CIDs in single regions would be very helpful indeed to guide the reader in how to navigate and interpret the different signs of change, confidence levels in the changes and strength of convergence of evidence. Presumably, this table can be split up and reproduced in each of the regional chapters of WG II - it'll be a very useful and globally consistent background to projected changes in the regions as well as providing a truly integrative product across the WGs. Add a worked example and the utility of the Table will be enhanced enormously. The colour scheme might also be reviewed - I particularly dislike the dominance of the black shading. However, congratulations on attempting something bold and new here. [Timothy Carter, Finland]	Not applicable. The box has been removed.
130237	34	32	38	16	Regional climate information is critical for understanding the type of climate threat(s) regions and governments will be facing and developing plans to assist in order to protect U.S. national security interests. A sentence or two should be added to the opening paragraph of Box SPM.3 specifically highlighting the need for regional climate information to assess climate-related threats and hazards. Citations: http://www.andrew-holland.com/uploads/6/3/1/7/6317360/79-88_holland.pdf and https://gjia.georgetown.edu/2020/03/18/preparing-for-the-inevitable-climate-change-and-the-military/ [Trigg Talley, United States of America]	Accepted. Relevant text now included in the revised SPM.
109443	34	33	34	33	The CID which can not be documented (air pollution and surface radiation) should be removed instead of having empty gridboxes. [Sophie Szopa, France]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66525	34	33	34	33	The SPM Box 3 summarizes many dimensions and probably needs more space. This is a very important section summarizing lines of evidence from 4 regional chapters and others like Chapter 9, 6 or 8, on a region-by-region basis. It would benefit from being a full section instead of a box. It has to stay "user-oriented" as presented in Section A.3, but will benefit from expanding on a few extremes from CH11. [robert vautard, France]	Not applicable. The box has been removed.
44877	34	35	34	35	Information on temperature changes etc. is climate information relevant to..., so this would need to be reworded. Perhaps "climate services information relevant to..." ("tailored" would be another alternative). [Markku Rummukainen , Sweden]	Not applicable. The box has been removed.
9543	34	35	34	36	Unclear phrasing, check grammar and intended meaning as this is a topic sentence for the whole box. Use of 'in focus' does not make sense. [Joelle Joelle Gergis, Australia]	Not applicable. The box has been removed.
101595	34	35			Change "risk assessment and" to "risk assessment, and" [Knut Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
81871	34	36			Insert a comma after "focus" [Dan Zwart, New Zealand]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
130239	34	41	34	41	[PRECISION] In Box SPM.3, the current GSAT warming is stated as 1.1°C (base period: 2009-2018), whereas in Box SPM.2, the current GSAT warming is stated as 0.9°C (base period: 1995-2014). It seems like this value and the base period should be standardized across the document, as 0.9°C is used elsewhere in the SPM. The same issue occurs in Table SPM.3. [Trigg Talley, United States of America]	Not applicable. The box has been removed.
17515	34	41			It talks about 'the current' GSAT warming of 1.10C - that needs a date as it won't be 'current' when the report is published? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
44879	34	42	34	42	What is the meaning of "higher"? Higher than what? (If the dimension is one of time, then "continued warming" or suchlike would be a better term.) [Markku Rummukainen , Sweden]	Not applicable. The box has been removed.
15361	34	43	34	43	"SPMA" is unknown. It should be more specific to be "SPM Section A.2". [Masaki Satoh, Japan]	Not applicable. The section of the revised SPM are not numbered and not referenced in the text.
9749	34	43	34	43	by SPMA is SPM A.2 meant? [Jonathan Lynn, Switzerland]	Not applicable. The section of the revised SPM are not numbered and not referenced in the text.
28021	34	43	34	43	Replace "Section SPMA" by "SPM section A.2". [Eric Brun, France]	Not applicable. The box has been removed.
101597	34	47			Change "The criteria that are used to highlight" to "The criteria used to highlight" [Knut Nadelhoffer, United States of America]	Not applicable. The box has been removed.
36263	34	48			Could you lucidly define CIDs so that it is clear that they do not drive climate but they drive impacts. [Michael PRATHER, United States of America]	Accepted. CID definition included as a footnote.
77609	34		35		Level of detail provided in methodology could be reduced or refer to relevant chapter, not necessary for SPM [Emer Griffin, Ireland]	Accepted.
90259	35	0	38	0	BoxSPM3 Table 1. The table is too "dense", the strenght of evidence is overly complex, it is hard to clearly see the meaning of the figures, the simple black borders are confusing. The description is too complex and isn't clean-cut for the reader. The evidence strength have many drawbacks, limitations and lack of data, while they are fundamentally different so we do not suggest merging the observed, attributed and projected changes. [Bernadett Benko, Hungary]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69421	35	6	35	6	"show" should be "shows" [Kaoru Magosaki, Japan]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
44881	35	6	35	6	Is this for RCP8.5 or SSP5-8.5? Clarity is important here as there is some difference in the respective forcing levels. [Markku Rummukainen , Sweden]	Not applicable. The box has been removed.
67679	35	6	35	6	Is this RCP as written, or SSP? [Karen Rosenlof, United States of America]	Not applicable. The box has been removed.
41341	35	6	35	6	It will probably be heavily debated if RCP8.5 is the adequate scenario to show here. Please provide a clear explanation why RCP8.5 was chosen. If it is to be kept, it should ideally be shown together with RCP2.6/RCP1.9. [Alexander Nauels, Germany]	Not applicable. The box has been removed.
130241	35	6	35	6	RCP 8.5 or SSP5-8.5? [Trigg Talley, United States of America]	Not applicable. The box has been removed.
50383	35	6	35	6	It would be helpful to unpack here the decision for the use of RCP8.5 only here for showing the projected direction of change for Climate Impact Drivers, and a clear explanation that this RCP assumes an extremely high greenhouse gas forcing scenario, centred around 2050' or similar. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
131803	35	6	35	6	the SPM has used SSPs up until now - now a switch to RCP8.5 - could a translation be added including temperature levels? [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
39933	35	6	35	6	Again why the focus on RCP8.5? [TSU WGI, France]	Not applicable. The box has been removed.
10217	35	6	35	10	Given criticisms about the lack of realism of RCP 8.5 emissions, perhaps it'd be better to focus on SSP3-7 or RCP 4.5, or perhaps even better to index to 2°C GSAT warming? [Robert Kopp, United States of America]	Not applicable. The box has been removed.
17517	35	6			The use of the term 'mid-century' - can it be made more specific? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Periods are clearly specified.
97405	35	6			Why using only the SSP5-8.5 scenario? [Nicole Wilke, Germany]	Not applicable. The box has been removed.
36265	35	6			show{S}' [Michael PRATHER, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
81873	35	6			"shows" [not "show"] [Dan Zwartz, New Zealand]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
101599	35	6			Change "Table 1 show present day" to "Table 1 shows present day" [Knute Nadelhoffer, United States of America]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
101601	35	8			Change "selection and the regional assessment of the CIDs has been shaped" to "selection and the regional assessment of the CIDs have been shaped" [Knute Nadelhoffer, United States of America]	Not applicable. The box has been removed.
41343	35	12	35	12	Cannot see 10 broader CID groups/categories in Box SPM.3 Table1 but only 6. [Alexander Nauels, Germany]	Not applicable. The box has been removed.
100333	35	13	35	13	For Southwestern South America, column Pluvial flood, there is medium confidence of decrease based on Atlas figures CMIP5, CMIP6 and Figure 12.11b [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
100335	35	13	35	13	For Southern South America, column Pluvial flood, there is medium confidence of increase based on Atlas figures CMIP5, CMIP6 and Figure 12.11b [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
100337	35	13	35	13	For Southern Central America, column Drought, there is medium confidence of increase based on Figure 12.6 [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
100339	35	13	35	13	For Northern South America, column Drought, there is medium confidence of increase based on Figure 12.6 [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
100341	35	13	35	13	For South American Monsoon, column Drought, there is medium confidence of increase based on Figure 12.6 [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
100343	35	13	35	13	For Southeastern South America, column Drought, there is medium confidence of decrease based on Figure 12.6 and Table 11.7 [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
111487	35	18	35	18	Change "that result in" to "for" [James Renwick, New Zealand]	Not applicable. The box has been removed.
81875	35	21			Insert a comma after "observations" [Dan Zwartz, New Zealand]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
132001	35	26			It must be made very clear that when you talk about attribution studies, you are not talking about the attribution of impacts to climate change. Such confusion may arise when the term CID is continued to be used (see comment re p. 3, line8). [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
28023	35	28	35	29	Why? Some explanations are needed. [Eric Brun, France]	Not applicable. The box has been removed.
97407	35	28	35	29	The notion of "there is no reason" does not explain this reason. Please revise. [Nicole Wilke, Germany]	Not applicable. The box has been removed.
101603	35	32			Change "There is a wide regional diversity in the regional signature of climate change" to "There is a wide diversity in the regional signature of climate change" [Knut Nadelhoffer, United States of America]	Not applicable. The box has been removed.
132241	35	40	38	4	Box SPM3, Table 1. Chapter 11 did not have a chance to sufficiently comment and contribute to this table. It will need to be very carefully checked in the development of the FGD and harmonized with chapter 11 material. [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
132279	35	40	38	4	Box SPM3, Table 1: Hail is either not relevant or displays no significant changes in any region. It would make more sense to remove it from this table. If the chapter 12 authors want to highlight hail in the SPM, this can be done with one sentence (however there is no material on hail in the present chapter 12 ES which would rather speak against this). [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
132283	35	40	38	4	Box SPM3, Table 1: Labels related to "key for strength of evidence coming from multiple sources": This seems redundant with the assessment of confidence in the table and is not that useful. For instance, one might lack some attribution studies in some regions for given extremes but confidence could be nonetheless high based on process understanding. [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
132285	35	40	38	4	Box SPM3, Table 1: Drought should be subdivided in 2 to 3 categories. There should be at least a distinction between precipitation-deficits based droughts ("meteorological droughts") and soil moisture/streamflow droughts (relevant for agriculture and water resources), or possibly between all 3 types of droughts. The reasons are as follows: 1) climate change signals are not the same for these 3 types of droughts, in particular not for the precipitation deficits vs the other types of droughts which are also affected by changes in evapotranspiration; 2) the impacts are very different for these 3 types of droughts [see chapter 11 assessment] [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
132287	35	40	38	4	"Heavy precipitation" should be mentioned in this table. [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
132289	35	40	38	4	Subdivide "Severe wind storms" in Tropical cyclones and extratropical cyclones. [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
132291	35	40	38	4	Consider possibly including compound events in this table (e.g. dry/hot events, humid/hot events). [Sonia Seneviratne, Switzerland]	Not applicable. The box has been removed.
9545	35	41	36	12	This table is not easy to follow. It is too complex to be useful. Results for Australasia seem questionable e.g. high confidence of landslides? I've never seen literature on this as landslides are not a common hazard in our region. [Joelle Joelle Gergis, Australia]	Accepted. The table has been removed.
7369	35	41	36	13	Box SPM.3, Table 1 groups CIDs into six categories whereas Table 12.1 groups them into 7 categories (by separating "Coastal" from "Oceans"). Please ensure consistency across the report. [Hans-Martin Füssel, Denmark]	Accepted.
104245	35	41	38	2	The readability of Box SPM.3, Table 1 could be improved by keeping the color code for the projected changes, and indicating the level of confidence by the letters L, M, H, as in the figure SPM.3 of SRCCL. [Philippe Tulkens, Belgium]	Not applicable. The box has been removed.
17721	35	41	38	2	Consider to place the legend for the colours and frames in the beginning of the table instead of in the end. That information is needed to understand the table. [Anette Jönsson, Sweden]	Not applicable. The box has been removed.
97409	35	41	38	2	Comments on Box SPM.3, Table 1: - This figure is not very useful: How can observations, projections and attribution be meaningfully merged in one little square? Please find another way to present this information in a more disentangled manner. - In a new way of presentation, please use more appealing colours that are more intuitive (e.g. dark to light or instead of frames use stippling). - What does radiation at the surface mean? - Please see our related comments on the TS. [Nicole Wilke, Germany]	Not applicable. The box has been removed.
34551	35	41	38	2	I realize that a lot of work went into Table 1 in Box SPM.3, and so I feel bad in saying that it falls far short in its mission of communicating information about changes in climate impact drivers at the regional scale. The table is packed with far too much information for too many impact drivers using a non-intuitive color scale for confidence levels and an even less intuitive box outline system for strength of evidence. [Russell Vose, United States of America]	Accepted. The table has been removed.
38971	35	41	38	18	This is another hugely helpful table. Can the colours be adjusted or probably symbols be introduced to make it more readable? The colour code does not explain itself, and the contrast between the filling and the margins is hard to see in some cases. Also, please use "ocean regions" instead of "oceans" above the last section. [Maike Nicolai, Germany]	Not applicable. The box has been removed.
42283	35	41			Box SPM3 Table 1: Consider leaving out the "strength of evidence" highlighting [Tina Christensen, Denmark]	Not applicable. The box has been removed.
78645	35	41			table 1 in box SPM.3. Wow this is the daddy of all complex tables! As per other comments – would be great in TS, but too much for SPM. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The table has been removed.
104247	35	43	35	43	The design of the table seems nice, but values of entries need to be scrutinized. Two examples: what is the meaning of decreasing frost in central Africa? Why are there only air pollution entries for North America, while there is a rich literature showing effects in Europe, East and South Asia. (see also p. 39; 1-9) The use of 'black' colors for not relevant is distracting, perhaps some light greyish dashed pattern. [Philippe Tulkens, Belgium]	Not applicable. The box has been removed.
42039	35	43	35	43	Box SPM.3, Table 1: The table extends over several pages. It is helpful for the reader if "key for confidence" and "key for strength of evidence" are repeated at every page. [Juhani Damski, Finland]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
109445	35	43	35	43	Box 3 Table 1: All the CID mentioned in this table except air pollution can be characterized by a single physical measurable quantities. According to the WHO definition "Air pollution is contamination of the indoor or outdoor environment", thus air pollution is too polymorph to be considered as a climate impact driver. The CID here should be the "surface atmospheric concentration of anthropogenic pollutant" whereas the air pollution is the impact of the CID. [Sophie Szopa, France]	Not applicable. The box has been removed.
15773	35	43	35	43	Box SPM.3, Table 1 holds a lot of potential and I look forward seeing the last version. I have a few comments. First, I suggest that "Snow and ice" as a CID is replaced by "Cryosphere", this would be more consistent with previous AR6 Special Reports (including SROCC) but also with the content of the table itself, because "permafrost" is neither snow nor ice. [Samuel Morin, France]	Not applicable. The box has been removed.
415	35	43	35	43	"lake acidity" has not been defined anywhere in this chapter. Many lakes, especially in the tropical zone, have naturally acidic waters i.e. pH below 7, and because of a combination of pH and temperature act mainly as CO2 sources to the atmosphere. Eutrophic lakes may shift seasonally from CO2 sinks to sources, and hypertrophic lakes may have strong diel (i.e. within 24h - day/night) shifts in their sink-source behaviour. Temperate region lakes may display, especially during spring and summer, a strong stratification, where upper, productive and oxygenated waters may uptake atmospheric CO2 through biological processes (primary production). However mixing during autumn and winter times (if the lake is not ice-covered) may bring "acidified, low oxygen waters from deeper layers to the surface, and then the ecosystem acts as a CO2 source to the atmosphere. Do you mean here coastal lagoons, that have salty to brackish waters, are usually shallower (i.e. wind and turbulence mixing of the water column is more efficient), where alkalinity may indeed regulate surface lake water pH? "Lake acidification" in our present times are very often associated to increase in domestic or industrial sewage or atmospheric deposition enriched in sulphur or nitrogen compounds, which indeed affects the trophic structure of the systems, menaces biodiversity, etc, but the process is different from the "ocean acidification" resulting from the dissolution of the anthropogenic CO2 in seawater. Studies on the impacts of lake acidification are listed here: 1) Bell, G., Fugère, V., Barrett, R., Beisner, B., Cristescu, M., Fussmann, G., et al. (2019). Trophic structure modulates community rescue following acidification. Proc. R. Soc. B Biol. Sci. 286, 20190856. doi:10.1098/rspb.2019.0856. 2) Čtvrtlíková, M., Kopáček, J., Nedoma, J., Znachor, P., and Vrba, J. (2020). Only the adults survive – A long-term resistance of <i>Isoëtes lacustris</i> to acidity and aluminium toxicity stress in a Bohemian Forest lake. Ecol. Indic. 111, 106026. doi:https://doi.org/10.1016/j.ecolind.2019.106026. 3) Leach, T. H., Winslow, L. A., Hayes, N. M., and Rose, K. C. (2019). Decoupled trophic responses to long-term acidification and associated hypoxia in Lake Glash. <i>Chemosphere</i> . doi:https://doi.org/10.1016/j.chemosphere.2019.125000.	Noted. The assessment covered changes in lakes aggregated over large sub-continental regions and the implications of physical climate changes on these and did not include more detailed information or on other drivers of acidification.
15775	35	43	35	43	I suggest that the subdivision "Snow and land ice" is replaced by two columns, one for "Snow cover" and the other one of "Glaciers". Indeed, the geographical location and response to climate change and impacts is very different for Snow cover and Glaciers. [Samuel Morin, France]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
15777	35	43	35	43	I suggest that "Snow avalanche" is removed from the table, although I personally work in the field of snow and avalanche research, I think this is a quite peripheral concern for a global-scale assessment like AR6 WG1 (and it has been covered by SROCC, with very limited additional literature published on the topic since SROCC release). If snow and land ice is replaced by "Snow cover" and "Glaciers" separately, then "snow avalanches" hazards/CIDs can be treated together with "Snow cover" [Samuel Morin, France]	Not applicable. The box has been removed.
8183	35	43	35	43	The design of the table seems nice, but the choice of color and values of entries need to be scrutinized. Two examples: what is the meaning of decreasing frost in central Africa? Why are there only air pollution entries for North America, while there is a rich literature showing effects in Europe, East and South Asia. (see also p. 39; 1-9) The use of 'black' colors for not relevant is distracting, perhaps some light greyish dashed pattern. [Frank Dentener, Italy]	Not applicable. The box has been removed.
100327	35	43	36	12	In my opinion this Table 1 is extremely confuse. The colors showing the projected changes are fine, but the frames are difficult to understand, trying to merge observed trends, future projections and attributions studies. [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
14571	35	43	36	12	What is indicated by black cells in the table is not mentioned in the caption. The different combinations of obs, proj, attrib used for the different colour frames are extremely complicated. It would be good if these combinations could be simplified such that the average adaptation practitioner can easily grasp the key intended message. As it is now, it requires several readings to fully understand what is indicated by the different colour frames. For e.g. the phrase "The gray frame indicates high confidence of a consistent message of change either from observed and high confidence projected changes or from attribution studies and projected changes (of medium to high confidence)" is very convoluted with all the "and"s and the "or" s in it. [Roshanka Ranasinghe, Netherlands]	Not applicable. The box has been removed.
96909	35	43	36	15	A descriptive colour bar at the top of the figure (this spans over multiple pages) would be a really useful addition to Box SPM.2, Table 1. Regarding salinity, there are multiple observational estimates of change, with model estimates of basin-scale change both for historical and future projections that provides more than a single line of evidence. Some of the more regional areas (Arabian Sea, Bengal Gulf) may need to be reconsidered [Paul Durack, United States of America]	Not applicable. The box has been removed.
9751	35	43	38	1	there's a tonne of valuable information in Box SPM.3 Table 1 but initially it's hard to work out though it's all explained. So a good candidate for an animated build-up for communications purposes [Jonathan Lynn, Switzerland]	Not applicable. The box has been removed.
2925	35	43	38	1	Air pollution should be given in each region. [Zong Ci Zhao, China]	Not applicable. The box has been removed.
38291	35	43	38	1	Box SPM.3, Table 1 is too complicated in coloring and layout, which makes the legend difficult to understand. It is suggested to modify it for an improved readability. [Yaming LIU, China]	Not applicable. The box has been removed.
50385	35	43	38	1	Box SPM.3, Table 1: It would be helpful if the key for this figure was above it rather than below it - perhaps it could be included in the legend with the description of the key? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
37659	35	43	38	2	Frames with orange and yellow colors may not be easy to discriminate. [Masahide Kimoto, Japan]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44083	35	43	38	2	The introduction of Climatic Impact Drivers offers the possibility to enhance consistency with WGII, as they can serve as a basis for more comprehensive impact assessments. This introduction can help clarify the blurry line between impacts and extreme events, for example. Generally, we encourage attempts to harmonise assessments across WGII. [Lamin Mai Touray, Gambia]	Noted. Many thanks.
44911	35	43	38	2	This is a very busy table. For readability it might be better to start with a short explanation of the aim of the table, and then display the legend for the boxes. Preferably the legend should be visible on each page, if the table is spread over more than one page. For policymakers, the information on strength on evidence might make the table unnecessary complex, it is not clear how this information might be used, in particular as the authors already have assessed levels of confidence. [Markku Rummukainen, Sweden]	Not applicable. The box has been removed.
54701	35	43	38	2	This table more-or-less duplicates Table 22 in the TS, but it changes the presentation in a way that is potentially confusing (and perhaps misleading). In the underlying Table 22 there is a clear distinction made between observed and attributed change and future projected change. In the corresponding table in the SPM, this clarity is lost -- past and future are muddled together in a way that is very difficult to trace. Overall, it is not at all obvious if this complex multi-page table is appropriate for an SPM. Indeed, our strong suggestion is to simplify this table by showing only projected changes in CIDs across regions. This would maintain a table in the SPM showing important information about regional changes, it would be more readily understood, and it would not involve merging different lines of evidence to arrive at confidence levels based on expert judgement. Focusing on future changes would, we think, be most relevant to policy-makers. [Nancy Hamzawi, Canada]	Accepted. The table has been removed.
87195	35	43	38	16	In general this Table and Figure are displaying too much information in order to be digestible or useful, especially for policy-makers, and they also increase the length of the SPM significantly (is both Box SPM3, Box SPM3 Table 1 and Box SPM3 Figure 1 really necessary). The regional breakdown is useful, but please consider reducing the amount of information displayed and also the colours currently used. Displaying confidence by colour plus the use of the orange/grey/yellow frame (displaying lines of evidence) means in our view too many colours are displayed. Moreover, when there are no frame what does that mean. The use of background colors at the top in the table (e.g. "Heat and Cold" and "Wet and Dry" etc.) seems to not be linked to the colors used for the same CIDs in the Figure. So please either make such a link or do not use background color unless really needed since the table is so busy anyway. Could the confidence level be displayed through a gradient of a similar colours rather than completely different colours (brown, blue, black etc.)? And could the use of colours be shown in a legend upfront, or on all pages, rather than simply explained in the text at the end? This would allow the reader to absorb and understand the figure faster. [Oyvind Christophersen, Norway]	Accepted. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130243	35	43	38	16	Box SPM.3 is a nice attempt to combine a lot of different information. It certainly takes a lot of time to really understand what is going on. A few suggestions to help make it more intuitive. The color scale is a challenge as it does not immediately convey any meaning. The use of purple and brown hold no meaning. Maybe that is why they were selected, but shades of red (increase) and blue (decrease) would carry more intuitive meaning. Also, for the orange, gray, and yellow box outlines to indicate that amount of evidence, it seems that they are out of order. Intuitively, gray to yellow to orange signifies an increase in the number of lines of evidence. Gray in the middle doesn't make sense. A goal of this table should be to make it as intuitive as possible for the most number of readers. Right now, one has to spend at least 5-10 minutes on this table to understand all of the nuance. Please consider alternate color options. [Trigg Talley, United States of America]	Not applicable. The box has been removed.
130245	35	43	38	16	Box SPM.3, Table 1: The frame colors are sometimes puzzling, contradicting the sense of the box color. For example, there is medium confidence for decreased drought on Eastern North America (light orange box color) with the highest level of evidence strength (orange frame). By contrast, there is high confidence in relative sea level increase many places, but with only medium evidence strength. And the CID that one would expect to be the most robust of all, increased atmospheric CO ₂ , has high confidence but only medium evidence strength. Not sure the frame colors add much value or clarity to the figure, at least for purposes of the the SPM. Consider deleting them. [Trigg Talley, United States of America]	Not applicable. The box has been removed.
86595	35	43			Box SPM3 Table 1. Regional CDIs. I understand it might be hard but it would be good to contrast a low (SSP1-1.9) and a high scenario here, not just showing the worst case scenario. You might want to consider showing less CDIs in the SPMs but for 2 scenarios, and showing the full list in the Technical Summary. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
41345	35	43			Please improve legend to facilitate the reading of this complex table, e.g. include obs/attribution/projections in the respective squares shown in the legend to avoid confusion. In order to facilitate comparison with the corresponding figure, maybe colours could be swapped with +/- symbols applying different levels of bold font to capture confidence of change. [Alexander Nauels, Germany]	Not applicable. The box has been removed.
28025	35	44	35	44	is it Figure TS.22 or Table TS.22? [Eric Brun, France]	Not applicable. The box has been removed.
28027	35	44	35	44	"TS Appendix 1" does not exist. Perhaps it's "Appendix TS.A"? [Eric Brun, France]	Not applicable. The box has been removed.
28029	35	44	35	44	Regarding footnote 14, sentence "with an assessment of the confidence in these from available literature combined with information on observed changes in these indices and attribution studies with the confidence that is associated to their findings.": the sentence is not easy to understand, please reformulate. [Eric Brun, France]	Not applicable. The box has been removed.
28031	35	44	35	44	Regarding footnote 14: replace "as well as highlighting" by ". It also highlights". [Eric Brun, France]	Not applicable. The box has been removed.
28033	35	44	35	44	Regarding footnote 14: "Technical Summary Appendix 1" does not exist. Perhaps it's "Appendix TS.A"? [Eric Brun, France]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
116121	35		35		I understand that an implicit choice for Box SPM3 is to combine information from observed trends, attribution studies, and robust projected signals. This requires a discussion on reasons why one would expect trends to be the same in the past and the future, in relationship with (multi) decadal variability, changes in drivers (incl regional RF linked to SLCF), and emergence. You could consider simplification of the table (eg aspects related to winds). [Valerie Masson-Delmotte, France]	Not applicable. The box has been removed.
17519	35		38		SPM.3, Table 1. If RCP8.5 is generally considered to be 'unrealistic' or 'unlikely' why is it used here? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
4095	35		38		this table looks complex and too specific in regions and climate variables. Is it possible modify it to provide general and comprehensive information? [Daoyi Gong, China]	Not applicable. The box has been removed.
86147	36	0	36	0	What does the asterisk on North Africa in BOX SPM.3, TABLE 1 mean? [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. The box has been removed.
15045	36	0	37	0	Box SPM3 Figure 1 is an example of unnecessary detail in the Summary. Policymakers' consultants seeking this level of detail should consult the main report. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
50387	36	0	37	0	Climate Impact Drivers (CID) Box SPM3.1 Table 1: this figure shows that air pollution as a driver has medium chances of increase only in America. Every other region, it is low. This is because the CIDs are based on RCP 8.5 (emission scenario) which assumes that air pollution controls are strong and these air pollution controls are projected to lead to a strong decline of ozone precursor. Due to the choice of RCP used the conclusions for this CID may be considered misleading. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
131807	36	0	37	0	Box SPM.3 Table 1 These tables are difficult to read - see SROCC SPM.2 as an example for displaying information [Hans Poertner and WGII TSU, Germany]	Accepted. The table has been removed.
131809	36	0	37	0	Box SPM.3 Table 1 should white in the legend be 'low confidence in change or no change'? [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131811	36	0	37	0	Box SPM.3 Table 1 Black for not broadly relevant is misleading. Maybe a little stipple or change low confidence to light grey and not relevant to white? [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131813	36	0	37	0	Box SPM.3 Table 1 Could other be air quality? I'm not sure of the value of adding atmospheric CO2 here and for radiation at surface it is not easily clear what this is [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131815	36	0	37	0	Box SPM.3 Table 1 I suggest not to put the title row in colours as these are confusing with the table cells [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131817	36	0	37	0	Box SPM.3 Table 1 Oceans panel - where is the southern / Antarctic ocean? [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131819	36	0	37	0	Box SPM.3 Table 1 Different lines of evidence is not explained anywhere and is this relevent to be seperated given this is part of the uncertainty assessment? This raises the question if confidence has been incorrectly applied here [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131821	36	0	37	0	Box SPM.3 Table 1 Oceans panel - why is lake acidity included under oceans? [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
131805	36	0			There is a * in the table behind "North Africa" indicating a footnote, but there is no footnote [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
130459	36	1	36	1	The Section D title is "Climate information to support mitigation and adaptation action" but key messages are mainly for mitigation. Please consider to include more adaptation relative points. [Panmao Zhai, China]	Not applicable. The box has been removed.
42617	36	1	38	1	If possible, please use more intuitive colours in boxes and as frames, for example shades from yellow to red (increase) and light to dark blue (decrease), and perhaps numbers or symbols instead of frames to indicate strength of evidence. [Sofie Schöld, Sweden]	Not applicable. The box has been removed.
28035	36	3	36	3	Although they are closely connected, why is RCP8.5 choosen and not SSP5-8.5 in this table? [Eric Brun, France]	Not applicable. The box has been removed.
100329	36	3	36	3	"for scenario RCP8.5" - If model projections are based on global, and regional model ensembles (CMIP5, CMIP6 and CORDEX), projections are not only based in RCP8.5. [Claudine Dereczynski, Brazil]	Not applicable. The box has been removed.
108201	36	13	36	13	This table would be very effective if presented in an interactive format. [Anton Holland, Canada]	Noted. Relevant information now available in the Interactive Atlas.
109495	36	13	36	13	Table 1: the SPM is supposed to elevate messages of high confidence. The columns containing too few robust information (when considering the correct scale of confidence defined in the IPCC uncertainty langage guide) should not appear in SPM. [Sophie Szopa, France]	Not applicable. The box has been removed.
109497	36	13	36	13	Concentrations of CO2 and SLCF are climate drivers. This is thus confusing to also call them climate driver impact. In addition their changes in the future are mainly controlled by anthropogenic emissions and thus this table, very visible if in the SPM can easily convey a confusing message. [Sophie Szopa, France]	Noted. They are both so relevant in this context.
109499	36	13	36	13	For air quality, only North America seems to have results in the table whereas lots of studies exist over Europe and Asia. [Sophie Szopa, France]	Not applicable. The box has been removed.
66441	36	13	37	3	I question some of these boxes for permafrost. As I noted in the comments in chapter 12, there is only weak evidence for permafrost in some of these regions where it is noted here (like North Africa), and there is some evidence that permafrost exists in other regions where it is absent here (IWest Central Asia?). [Charles Koven, United States of America]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23413	36	13	37	4	The entries of this table are the exact same as in Ch12 CIDs. This was a good start for the SPM FOD, but this should be modified for the SOD: 1. the table should consider relevant entries (e.g. changes in extremes) also from other chapters, since the Box SPM.3 should be a regional synthesis from the entire WG1 AR6 report. There has been a suggestion to consider at least pluvial and hydrological drought for example (agricultural drought could also be considered if assessed in any other chapter). 2. Some entries could, when displayed seperately in the SPM and without the context given by chapter 12 be very confusing. The "Atmospheric CO2" is the primary example of this, it really needs the context provided by Ch12 to be understood. 3. Other entries that are relevant in Ch12 (Ch12 only display the projections of the CIDs) becomes irrelevant in this table (where the color depends on the combination of projections, observed changes and attribution). The primary example is "hail" which is white for all regions except for some regions where it is black for "not broadly relevant". [Anna Amelia Sörensson, Argentina]	Not applicable. The box has been removed.
105607	36	13	38	1	Great table, not so sure about the 1970s colour scheme. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
80163	36	13	38	2	Table remarks: 1) Australasia boxes should not be bordered as it indicates the region as a whole was also assessed. Though it would be worth checking if large regions share the same direction of changes as the world or the sub-regions. 2) We would consider using different colours for the increase and decrease direction of change. Maybe red and blue or something different from purple. 3) It would worth placing the key box next to each page under the tables. 4) The not-relevant category plotted as black is a bit unfortunate as it could be seen as the strongest (purple) change. Maybe crossing those cells would be a more optimal solution. [Lilian Fejes, Hungary]	Not applicable. The box has been removed.
32391	36	13	38		With the current color code I find it very hard to draw the essential information from this table. Especially the black boxes (which should indicate no relevance) attract a lot of attention. I would suggest to make them rather gray or another color that is less striking. Instead of using different colors for evidence, I would suggest to use three different color saturations (or at least be consistent in the order of the colors, e.g. going from yellow to red to violet). [Clemens Schwingshackl, Norway]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28037	36	13			<p>Regarding SPM Box.3 Table.1:</p> <p>We appreciate the usefulness of table 1. However, this diagram will need reworking to make it understandable ; it tries to present too much information and it becomes unreadable. The distinction between light and dark is very unclear ; also, it's very confusing when printed in black and white. Black is for "not broadly relevant" but is the colour that stands out. Coloring the legend "Climatic Impact Driver : Heat and Cold, Wet and Dry, [...], Other" is confusing, as there are already a lot of colors on this table. The legend of the table has to be presented at the beginning of the table, not at the end.</p> <p>We have several other comments and recommendations, regarding the content of the table:</p> <ul style="list-style-type: none"> - the added value of considering 2 different ways for expressing the confidence (level + strength) is questionable. In order to increase the understanding by policy-makers, we recommend to display only the level of confidence which is more familiar. - we recommend to add an information on the intensity of increase/decrease relative to the current variability, using familiar symbols such as ++, +, ., - and --. <p>An alternative would be to use colors for the intensity and symbols H, M and L for the level of confidence in a similar way as Panel A of SRCCL Fig SPM.3. Moreover, the table would be more readable.</p> <ul style="list-style-type: none"> - some drivers such as CO2 do not seem very informative. - As during the approval session of the SROCC, we insist on the inappropriate use of the term Central Europe which cannot be used to encompass Western Europe. <p>[Eric Brun, France]</p>	Accepted/Not applicable. The box has been removed.
86201	36	13			Table SPM3 Fig 1: Need to make it clearer for the reader how the various lines of evidence combine to give the confidence levels indicated in the Table to enable the reader's understanding. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. The box has been removed.
81931	36	14	36	14	<p>Please check the accuracy of the table at the end of page 36 in relation to New Zealand. The AR5 indicated high confidence in fewer cold extremes and more hot extremes for both Australia and New Zealand, whereas the box for extreme heat here is white - the white colour indicates absence of a clear sign of change or low confidence in the change.</p> <p>The authors should check whether the information in this box (and other boxes in the IPCC report) is derived from the most accurate datasets e.g. the AR5 WGII may have used local station data to derive those high confidence trends, whereas the table may be using information from a global database. [Dan Zwartz, New Zealand]</p>	Noted. Information checked and updated.
81961	36	14	36	14	Box SPM.3, Table 1. Greatly appreciate the finer division of geographical regions, compared to the AR5. Thanks. [Dan Zwartz, New Zealand]	Noted. Thanks.
81651	36	14	36	14	<p>In Box SPM.3, Table 1 for the line on Southern Australia (SAU), the box on frost needs to be coloured white or at least light brown. There is evidence for an increasing trend in frosts in some regions in southern Australia in some seasons (notably spring), .: https://link.springer.com/article/10.1007/s10584-016-1763-5. This trend may or may not be due in part to a forced change in the circulation driver, that is perhaps detectable in individual frost events, e.g. http://www.ametsoc.net/eee/2016/ch29.pdf [Michael Grose, Australia]</p>	Noted. Information checked and updated.
12105	36		36		Should the "Not broadly relevant" boxes be white, instead of dark colour? [Prabir Patra, Japan]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17521	36		37		SPM.3, Table 1. Do the headings 'Heat and cold', 'Wet and dry', 'Wind' etc. really need to be repeated three times. Surely they are only needed at the top of each page. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
42369	36		38		SPM.3 table. Challenging with different color codes for both boxes (level of confidence) and frames (strength of evidens) [Tina Christensen, Denmark]	Not applicable. The box has been removed.
35281	36		38		This table (box SPM.3 Table 1) only uses scenario 8.5 which will subject it to withering criticism and questioning IPCC's integrity and intent. You should have a second table with one of the lower scenarios for contrast. I realize that expands the SPM a couple of pages but it is necessary for its credibility. [patrick Michaels, United States of America]	Not applicable. The box has been removed.
131823	36		38		Comment to Box SPM.3 Table 1: The table is extremely overloaded with information not understandable for laymen in my opinion. Consider restructuring and using colours that differ highly. I had to zoom-in to differentiate colours used, this would be impossible in a printed version. It is not easy e.g. to vary between orange and yellow frame. Potentially consider using signs to avoid overload with colours. [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
107501	37	0	37	0	The table needs to define/explain the difference between these two sub-regions listed under the "North America" region: "North Central America" and Central North America." [Hunter Cutting, United States of America]	Not applicable. The box has been removed.
26249	37	1	37	1	Should not the "Northern Central America" be part of the "Central and South America" section? Why is this differentiation here? In the Interactive Atlas there is only one CAM region. [Tania Guillén Bolaños, Germany]	Not applicable. The box has been removed.
42423	37	2	27	3	Table also considers coastal and oceanic features. Change heading to "Polar regions" [Tina Christensen, Denmark]	Not applicable. The box has been removed.
74019	37	2	37	3	For Mediterranean, it is not clear if the sea level rise and marine circulation modelling used for the assessments took into account the significantly increased sea water outflow trough Suez Canal (making it the largest "river" inflow into the Mediterranean since the beginning of the 1990s, due to its deepening and widening, and its bringing warm and much saltier water upon their passage in the canal trough the Bitter Lakes region, inserting large amounts of salt in the Eastern Mediterranean, and the doubling of the canal in its central section with further increase of salt insertion in the Mediterranean. Also, the modelling should have covered the practical cessation of waters from the Nile river after completion of the high Aswan dam in 1965, which reduced from millions of cubic meters per year to about 5,000 cubic meters per year, afterwards. The additional large amounts of salt insertion in my view are the reason for larger sea level rise measured so far in the South Eastern Mediterranean and for the increasing seawater salinity in the area. http://www.ciesm.org/online/archives/abstracts/pdf/40/Vol40_opt.pdf , p. 96. [Sergiu Dov ROSEN, Israel]	The assessment is based on all the available literature that is either specific for the Mediterranean or is global. The modelling of the Suez Canal and Nile river is specific of each assessed paper and can be dynamically modelled or parametrized, but in both cases is taken into account.
104477	37	3	37	4	SPM Box3: Permafrost in West Antarctica shows 'High confidence of increase': this is not supported by any statement/reference. [12.4.9.5] 12-105, L20-23: "...Future projections indicate decreases in permafrost extent and increases in permafrost temperature and active layer thickness across the Arctic and the increasingly ice-free portions of Antarctica (Chapter 9).".....=> This statement "Future projections indicate... the increasingly ice-free portions of Antarctica (Chapter 9)" does not refer to changes in permafrost in Antarctica. [Irina Gorodetskaya, Portugal]	Not applicable. The box has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
5305	37	37			Figure SPM.1 I cannot find any take-away message from this figure. I also note that it is so complex that it has not only a long figure caption but much of Box SPM.3 is spent explaining it. It requires a “traceback matrix” to understand it. I can see a lot of work went into the figure, but it is just too complicated for the SPM. [Daniel Murphy, United States of America]	Accepted. Figure has been reformulated.
81225	37		37		In Box SPM.3, Figure 1, it is not clear why mediterranean is in the Europe part? It is important to correct this by for example "southern Europ" or "northern Mediterranean". In all cases it can not be Mediterranean as this term means southern European, north Africa and even part of Asia. Please see also definitions of the IPCC regions. [Fatima Driouech, Morocco]	Noted. MED is also used for relevant parts of North Africa and this is made clear in the text where it is also included in the Africa synthesis of results.
131825	38	1	38	1	Why is Sea Ice as Climatic Impact Driver in the Southern Ocean (Southern Atlantic/Indian and Pacific Ocean) not relevant? Its development is a key factor for observed ecologic changes, so why do you list it as not broadly relevant (for climate?) [Hans Poertner and WGII TSU, Germany]	Not applicable. The box has been removed.
44883	38	1	38	16	It is stated that "regional oceanic areas" are included, but such areas as the Baltic Sea and the Mediterranean would not seem to be covered. Would it be possible to include these as well, or at least note that information has not been available for all marginal seas of interest (if this is the reason...)? [Markku Rummukainen, Sweden]	Not applicable. The box has been removed.
42041	38	5	38	5	BOX SPM.3, Figure 1 is very hard to read. Most of the map is without information. Wouldn't a table similar to the Table of Box SPM.3 be easier to read? Or is there a way to include this information to the Table of Box SPM.3? [Juhani Damski, Finland]	Accepted. Figure has been reformulated.
65637	38	5	38	16	Suggest revising the Figure significantly. It is currently very difficult to understand at a glance. The regions are barely visible as faint grey backgrounds, and the three-letter abbreviations will not be understood by many readers. 1) Suggest including a separate map for each continental region: North America, Africa, etc. 2) Suggest separating observed from projected changes: this is a crucial distinction that many non-scientific readers do not understand now. 3) Suggest clarification. The current figure conveys the idea that we have at least Medium confidence in all the depicted changes, whereas the text indicates low confidence for some climatic phenomena. [Kushla Munro, Australia]	Accepted. Figure has been reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28131	38	5			<p>Regarding Box SPM.3 Figure.1:</p> <ul style="list-style-type: none"> - We propose to delete Box SPM.3 Figure.1. - This figure displays too much information and is not readable at all. The pies actually hide most of the regions they are referring to, so that is is very difficult to understand to which areas they correspond. - The added value of this figure is not significant compared to Table 1. We are in general in favour of using maps to convey the information of Box SPM.3 but the current figure is not easy to interpret, especially regarding the oceanic basins (it seems that only North Pacific Ocean is informed). - In order to shorten the SPM, we suggest to choose between Box SPM.3 Table 1 and Figure 1. We prefer to keep Box SPM.3 Table.1. If Figure 1 is chosen, we recommend to consider how to clarify the information: <ul style="list-style-type: none"> - as in Table 1, we recommend to display only one type of confidence level - we recommend to add an information on the intensity of increase/decrease relative to the current variability. - To achieve both recommendations, colors could be used for the intensity and symbols H, M and L for the level of confidence in a similar way as Panel A of SRCCL Fig SPM.3. [Eric Brun, France] 	Accepted. Figure has been reformulated.
37661	38	7	38	14	<p>Sorry, but I had a few troubles reading Box SPM.3 Fig.1</p> <ul style="list-style-type: none"> - Which are the "10 broader classes"? 10 different colors in the legend near the bottom of Fig? So, we don't distinguish different drivers with the same color? It took me quite a while to master such convention. - Is the placement of the 10 classes same for all the pie charts? If no, how they are ordered? - What are the differences between the 1st and 2nd rows of the CID legend near the bottom of the Fig? - Frames with orange and yellow colors may not be easy to discriminate, especially with 10 filled colors for the pies. [Masahide Kimoto, Japan] 	Not applicable. Figure has been reformulated.
44085	38	7			This overview figure on Climatic Impact Drivers will proove to be very useful once figure design and clarity have been improved. [Lamin Mai Touray, Gambia]	Noted. Figure has been reformulated.
86597	38	7			Box SPM3 Figure 1. I'm sorry but this figure is a bit useless as it stands. I can summarise it as + everywhere for warming, and - everywhere for snow and cold stuff. Only exception is the water cycle with a few regions going against the general direction. Also it doesn't provide much (any?) extra info from the table above. It's just a different way to show the same thing... [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Figure has been reformulated.
41347	38	7			It is very hard, if not impossible to reconcile this figure with Box SPM.3 Table 1. At least the categories should be made consistent, and a common colour scheme should be defined as well. [Alexander Nauels, Germany]	Accepted. Figure has been reformulated.
99997	38	7			This figure showing a regional disaggregation of CIDs is in very useful in principle. Accessibility of this figure, however, needs to be improved. Recommendation to give a clearer indication on positive and negative changes if possible [Caroline Eugene, Saint Lucia]	Accepted. Figure has been reformulated.
36267	38	7			I applaud the Table and Figure here, but a warning based on experience with the AR5 WGII plenary, the governments get very touchy with maps that show climate impacts and they will want to make sure that any climate impacts their country has felt are included in the map. [Michael PRATHER, United States of America]	Accepted. Figure has been reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68819	38	7			A figure showing a regional disaggregation of CIDs is in very useful. It must however be clear to interpret and understand. For example, you might to clearly indicate the positive and negative changes if possible and where possible (e.g. decreases in snow cover and drought risks both have the same sign). [Jeffers Cheryl , Saint Kitts and Nevis]	Accepted. Figure has been reformulated.
28039	38	11	38	11	This is an unusual way to express informations in an IPCC report. The sentence should be reformulated : "... for which there's high confidence in....". [Eric Brun, France]	Not applicable. The box has been removed.
20353	38	21	38	21	The title given here to section D of SPM is twice misleading. First, climate information is only addressed (partially) in one subsection out of 5. Second, this section is not concerned with adaptation at all. Its focus is mitigation of climate change. Actually, at first sight, D1 to D4 would be logical parts of a section headed "Limiting climate change", D1 becoming "The carbon budget" for example. The issues addressed by D5 (information, air quality, climate services) are totally unrelated to the mitigation. [philippe waldeufel, France]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: - The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change The 3rd and 4th sections now focus on adaptation and mitigation, respectively.
96911	38	21	41	24	There is an opportunity here to call out WG3 and technological advances which provide an up-beat perspective on the "opportunity" of climate change mitigation. The acknowledgement of COVID-19 shutdown period insights may provide a method to anchor a "positive" message about change that is possible [Paul Durack, United States of America]	Noted.
38293	38	21	44	22	The assessments on mitigation of and adaptation to climate change in this section are imbalanced. The title of Part D is "Climate information to support mitigation and adaptation action", but its specific content basically focuses on mitigation with limited reference to adaptation. It is suggested to add the adaptation relevant conclusions in Part D to balance the description of mitigation and adaptation. [Yaming LIU, China]	Taken into account. The revised section solely focuses on mitigation but the revised 3rd section now includes adaptation.
86997	38	21	44	22	Please include in the SPM section D (either D1.5 or D5.3 seems to fit) information based from the following: Neither ambitious climate change policy nor air quality abatement policy can automatically yield co-benefits without integrated policies aimed at co-beneficial solutions (Zusman et al., 2013; Schmale et al., 2014b; Melamed et al., 2016), particularly in the energy generation and transport sectors (Rao et al., 2013; Thompson et al., 2016; Shindell et al., 2018; Vandyck et al., 2018){copied from Ch6. p. 60, l. 16-19}. [Oyvind Christophersen, Norway]	Taken into account. The revised D2.2 in the final SPM takes this into account.
86999	38	21	44	22	In the TS it is currently written "The Special Report on Global Warming of 1.5°C (SR1.5) report concluded that achieving Paris Agreement goal, including limiting warming to 1.5°C, would require simultaneous and ambitious reductions of SLCFs and long-lived GHGs within the next decades. However, except for methane and halogenated species, regulations of SLCF emissions have so far been decided somewhat independently from climate policies. A dedicated set of policies developed with a focus on co-benefit solutions would be required to maximize climate mitigation and air quality improvements. {TS3.6, 6.5, Box 6.2, FAQ 6.2}". We feel that the focus on the need to achieve co-benefits between climate and air pollution drivers is currently missing in the SPM. [Oyvind Christophersen, Norway]	Taken into account, we have tried to add this aspect in HS13.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17723	38	21	44	24	The preamble for Section D is very good but some of the content in Section D is very condensed and might be hard to understand for a policymaker that need the information to support its decision making. [Anette Jönsson, Sweden]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved and is more accessible to non-scientific audiences. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
86489	38	21	44	24	Section D - We welcome the addition of this section. This section should be clearly linked to WGII and WGIII work that will have further detailed information on adaptation and mitigation. [Ala Taimar, Estonia]	Taken into account. WGII and WGIII mentioned in footnote 22. Note that in the revised SPM, the 3rd section explicitly mentions adaptation and the 4th 'limiting climate change' so both sections are acting as handshakes to the other working groups.
111691	38	21			Suggest delete 'and adaptation'. The section appears to refer only to mitigation. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change The 3rd and 4th sections now focus on adaptation and mitigation, respectively.
81513	38	23	38	23	The word 'PREMBLE' is not italicised. [Ee Ling Lee, Malaysia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
90789	38	23	38	23	Delete the word "Preamble" because it introduces an essential ambiguity in the SPM. For policymakers, the word Preamble in a document means that it is not an "operative" or "executive" part of the document, and therefore that it can be treated as a "nice to have" but not a necessary part of the document. On the other hand, SPM is, by definition, a document where every statement has a high scientific content and nothing is "preambular" in nature. All SPM is "operational" or "executive" and nothing is preambular. [José Romero, Switzerland]	Taken into account. Sections are now introduced with a short paragraph in italics, not in a box nor with the word 'preamble'
53517	38	23	38	28	The first sentence looks like a wishful statement. Suppress or rephrase as: Well-informed decision-making about climate change mitigation and adaptation needs comprehensive and easy-accessible climate information. [Hervé Douville, France]	Not applicable. Section introduction completely rewritten.
90213	38	23	44	24	The current section D contains the most policy-relevant message of the SPM into the framework of the Paris Agreement, but putting them at the very end risks that most policy-makers will not read them. This is why we propose to move current section in modified form, as we will comment on, to the beginning of the SPM, as we already mentioned in the reorganization of the SPM. [Georges Gehl, Luxembourg]	Rejected. This would not reflect the main messages from the underlying chapters. Note however that the SPM has been significantly shortened and the new headline statements are now shorter and sharper. We believe that this does elevate the information contained in the section.
26347	38	23	47	23	C.1.3 paragraph is all in italics [María Santolaria-Otín, France]	Accepted. In the revised SPM, the only parts italicised are the uncertainty language and the introduction of each section.
9753	38	24	38	24	"advances" not "advancements" [Jonathan Lynn, Switzerland]	Editorial.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17523	38				Table legends: these would be better before, not after, the Table. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
77075	39	1	39	9	This is a very important section and perhaps can be made clearer by separating the various components which determine the earth's energy balance, and how they need to be addressed. [Emer Griffin, Ireland]	Rejected. This not compatible with as shorter SPM.
77077	39	1	39	9	A simple message that to stabilise the global temperature at any level requires achievement of net-zero emissions can be provided. This can then be related to the Paris Agreement temperature goal. How and why negative emissions may be needed can then be explained, the time horizon for these should be included. [Emer Griffin, Ireland]	Accepted. This is done in HS13.
77079	39	1	39	9	A simple message on short lived climate forcings can be included and how these can be part of effective policy. This should include ground level ozone. This would be separate but linked messages. [Emer Griffin, Ireland]	Taken into account. HS13.9 is about methane, aerosol and ozone precursor emissions
90215	39	1	39	9	This headline statement is the main policy-relevant message for climate action of the whole SPM and needs to be elevated to a more prominent position of the SPM, supplemented with the main message the carbon budgets are approximately 100 Gt CO ₂ smaller than previously assessed as well then main reason why this is the case (please also consider our comment on the temperature re-assessment in this context) [Georges Gehl, Luxembourg]	Taken into account. Headline statements have been shortened and sharpened, which should - hopefully - make the messages they carry much more prominent.
26251	39	1	39	35	In CH1 Executive summary, there is mentioned that current NDCs are insufficient to achieve the PA. This information should be added in one of these two statements here (so that can be elevated to the main D1 statement), as well as the projected increases of T _g under current NDCs should also be added (2.6-3-5°C mentioned in page CH1 page 15 - section 1.2.2). This information, here at the beginning, can help to increase awareness of policymakers. [Tania Guillén Bolaños, Germany]	Rejected. It is beyond the mandate of WGI to assess the current NDCs in the Context of the Paris Agreement
50389	39	1	39	35	Suggest that the D.1 box highlights that the feasibility of pathways involves economic/technical/political capabilities and refers the reader to WG3 for this details. Overall section D is focused largely on temperature - suggest it would also be useful to mention other aspects such as SLR. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The narrative of the whole SPM has been significantly revised and headline statements are now much simpler and shorter to provide a high level summary of the SPM. As a result, the suggestion is too detailed for the revised headline statement.
112609	39	1	39	35	The SR1.5 SPM stated "Reaching and sustaining net zero global anthropogenic CO ₂ emissions and declining net non-CO ₂ radiative forcing would halt anthropogenic global warming on multi-decadal time scales (high confidence). The maximum temperature reached is then determined by cumulative net global anthropogenic CO ₂ emissions up to the time of net zero CO ₂ emissions (high confidence) and the level of non-CO ₂ radiative forcing in the decades prior to the time that maximum temperatures are reached (medium confidence)." This all seems pretty policy-relevant, and I'm struggling to see where it is said clearly here. The SR1.5 language could undoubtedly be improved upon. For one thing, you could explain somewhere that "net non-CO ₂ radiative forcing" means "total warming impact of other anthropogenic climate forcings on the global energy budget", which would really help comprehensibility. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. HS13 now states "Limiting human-induced global warming at any level requires achieving net zero CO ₂ emissions. Furthermore, stringent methane emissions reductions would limit additional non-CO ₂ warming and improve air quality." and is further supported by the bullet points HS13.1-HS13.9.
111795	39	1	40	7	The section on carbon budgets should include a rough quantitative estimate how the adjusted method of calculating carbon budgets compares to AR5 and or SR1.5. Probably not an easy thing to do, but policymakers are going to ask this anyway, just as they did for SR1.5 SPM [Oliver Geden, Germany]	Accepted - included in HS.13.3

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
555	39	1	40	20	To make it clear for policy makers, I recommend to be more explicit : To reduce CO2 émissions and tend to net zero emissions, it is mandatory to limit the use of fossile fuels in a very rigid manner. This implies to deeply revise current policies for buildings, transportation and electrcity production. The notion of "carbon budget" is academic and need to be translated in facts. It would be very effective that IPCC clearly expresses the need to stop using fossil fuels for electricity production and useful for the policymakers who have to address social sensitivity on the subject. Ideally, I would be please to read that nuclear and renewables, including hydropower are the best tools for electricity production. [Michel SIMON, France]	Rejected. The suggestion is policy-prescriptive.
12683	39	1	41	21	The delayed responses of ocean and cryosphere changes and the irreversibility of climate change means adaptation is needed (get prepared and act to lower the risk) besides of the "reductions in GHGs" (mitigation). This is not developed in SPM-D, but super important here and will provide important basis for assessments in working group 2 and 3. [Lijing Cheng, China]	Noted. New section D is on limiting climate change so it wouldn't make sense to mention it there. Note that HS9 is about irreversible/committed changes.
78823	39	1	41	26	D.1: This section (and in fact the entire SPM) lacks information about climate carbon cycle feedbacks and biosphere responses. [Peter Cox, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - This has been included in the revised draft under HS.8
23415	39	1	42	7	I find D.1 and D.2 diffciult to read. I think that the language could be improved, using simpler sentences and perhaps omit some details. Also, a reduction in paragraph length might be helpful for readability. The paragraphs are longer than in sections A-C and D.3-5. [Anna Amelia Sörensson, Argentina]	Taken into account. Language simplified in HS13 and throughout the SPM.
7717	39	3	39	3	It is strongly recommended to delete "further" because unfortunately until now it was not possible to reduce climate change - at best the speed of climate change has been reduced forvery limited time periods, e.g. in the years 2008/2009 due to the economic crisis, but climate change will only start to come to an end at the point in time by when a balance between emissions and removals at global level will have been achieved. Until that point in time climate change will continue. This message is included in the second sentence. [Klaus Radunsky, Austria]	Noted - all headline statements have been carefully revised
87351	39	3	39	4	This is too general information; we need more clear indications when global emissions need to be net zero for meeting 1,5 and 2 degree targets with a likelihood of 66% or more; Otherwise AR6 will be less clear than AR5. Also it should be indicated if budgets have changed since AR5 (apart from years passed). [Marcel Berk, Netherlands]	Rejected - This information is available in Table SPM.2
17525	39	3	39	4	Box, first sentence: isn't a timescale or other sense of urgency required here? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - timescales of action are assessed in WG3, but are informed by information in figures SPM.4 and SPM.10
93625	39	3	39	4	One important point that is missing is that the reduction of GHG emissions must start very quickly, and must be very substantial (and not just substantial) to be in line with the Paris agreement. More generally, there is almost no indication in the D.1 section of the evolution over time of emission reduction, when in fact there are strong constraints that stem directly from everything that is known. [Jean-Louis Dufresne, France]	Taken into account - this message has been carefully reconsidered and reflected in HS.13.9 in the revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7719	39	3	39	8	The current wording is not really correct (see also the above comment). The following wording is suggested (building on paragraph D.1.1): The global mean temperature increase depends mainly on the cumulated CO2 emissions (the carbon budget). This implies that global anthropogenic CO2 emissions would at least have to be brought down to net zero levels to stabilize warming. Reverting global warming to significantly lower temperature levels once it has exceeded a specific temperature limit would require global net CO2 removal (high confidence). Reductions in aerosol precursor emissions to improve air quality would lead to additional near-term warming which need to be addressed by additional measures. [Klaus Radunsky, Austria]	Noted - all headline statements have been carefully revised
42043	39	3	39	9	Reader may not know the content of the Paris agreement and "levels consistent with Paris agreement" may be difficult to understand. In addition, concepts net zero, net negative and net non-CO2 forcings may not be familiar. [Juhani Damski, Finland]	Accepted - The headline statement has been simplified to HS.13
9547	39	3	39	9	This is a critically important statement that needs to be improved. There needs to be a very clear statement that achieving the 1.5C end of the Paris Agreement targets is now impossible. What is the likelihood of 2C based on CMIP6 and current NDCs? Need to specifically state WHEN net-zero or net-negative GHG emissions would need to be achieved by to reverse/stabilise current warming trend to meet Paris Agreement. We need to be honest about what is feasible given the best possible information at hand. False hope is not helpful in an already very fraught policy environment. [Joelle Joelle Gergis, Australia]	Rejected - the suggestion requires information that is only assessed in WG3
78977	39	3	39	9	This message is important. It is indeed useful to consider the issue of cooling aerosols reduction, which links mitigation, air pollution and scenario related issues. However, it seems that the current focus on methane and ozone might be incomplete, at least because section D1.3 mentions methane and black carbon. Could phasing-out fossil fuels bring enough benefits in term of methane fugitive emission reduction, changes in O3 precursors, and reduction of BC emissions to counteract a large part of the warming associated with reduced sulfur emissions? [Martine Vanderstraeten, Belgium]	Taken into account - this message has been carefully reconsidered and reflected in HS.13.9 in the revised draft.
130247	39	3	39	9	The short-term warming effect of reducing aerosol precursor emissions should be more clearly counterbalanced with the immediate benefits of reducing air pollution. Consider modifying the last sentence in the summary box as follows: "Reductions in aerosol precursor emissions to improve air quality (AND THEREBY PROTECT PUBLIC HEALTH AND IMPROVE COMMUNITY RESILIENCE TO CLIMATE STRESSES) would lead to additional net near-term warming, which could be lowered by reducing methane and other ozone precursors simultaneously (high confidence)." [Trigg Talley, United States of America]	Taken into account - this message has been carefully reconsidered and reflected in HS.13.9 in the revised draft.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87001	39	3	39	9	This highlighted conclusion is important and quite well formulated as it stands. It is good that the Paris Agreement is referenced, and a good rationale is given for why net-zero or net-negative CO2 emissions are needed. However, the fact that there is a huge difference of the calculated need for net-negative CO2 emissions between scenarios that stabilize and those that decreases non-CO2 emissions is currently not so well reflected. In addition, the concept of temperature overshoot, and how a peaking and declining temperature versus stabilization at a temperature level influences the amount and need for implementing negative emission technologies. Please consider to highlight some of these perspectives in either D.1, or in any of the other highlighted conclusions under Section D. [Oyvind Christophersen, Norway]	Taken into account - Section D has been carefully reconsidered to reflect these aspects in the revised HS.13
117243	39	3	39	9	Why is the verb "would" used in this paragraph, and not "will" ? [Maisa Rojas, Chile]	Editorial - to avoid policy prescriptiveness
117245	39	3	39	9	shouldn't this be " ...substantial and sustained reduction of..., until net-zero is reached"? Or something like this? [Maisa Rojas, Chile]	Editorial - this has been edited
3587	39	3	39	35	It would be better to show how much cumulative CO2 has been emitted by the end of 2020 and approximate year when carbon budget will be exhausted for 1.5 and 2.0°C if we continue current emissions in future. For this purpose the following explanation from SR1.5 SPM would be of some help. Quote "By the end of 2017, anthropogenic CO2 emissions since the pre-industrial period are estimated to have reduced the total carbon budget for 1.5°C by approximately 2200 ± 320 GtCO2 (medium confidence). The associated remaining budget is being depleted by current emissions of 42 ± 3 GtCO2 per year (high confidence). The choice of the measure of global temperature affects the estimated remaining carbon budget. Using global mean surface air temperature, as in AR5, gives an estimate of the remaining carbon budget of 580 GtCO2 for a 50% probability of limiting warming to 1.5°C, and 420 GtCO2 for a 66% probability (medium confidence)". This may be one of the most important messages of WG1 report. [Mitsutsune Yamaguchi, Japan]	Taken into account - the historical emissions are given for the time period over which data was available. The time by which the budget would be exhausted depends on the pathway, which is assessed in WG3.
50399	39	3	39	35	I think it would be helpful if the body text in D1 could cite KEY remaining global carbon budget values linked to Paris goals (e.g. median values for 1.5 and 2.0 degrees scenarios)? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - estimates of carbon budgets rely on a set of normative choices (temperature limit, likelihood, contribution of non-CO2). Any selection by the IPCC would be policy prescriptive here. This data is covered in Table SPM.2
36269	39	3			The facts are all fine, but the first 2 sentences are the headline, put the rest below. The statement about non-CO2 is very important and should be the lead in a bullet. [Michael PRATHER, United States of America]	Taken into account - see revised SPM
41263	39	4	39	4	I think "net non-CO2" should really refer to SLCFs specifically; the statement, as it stands, isn't true for N2O and other long-lived GHGs. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - in this case it refers to all non-CO2 forcing not just the SLCFs
87465	39	4	39	4	The climate system WILL continue to warm unless... (not 'would') [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Headline statement significantly rephrased, warming of climate system no longer mentioned there.
130249	39	4	39	4	Should read "...climate system will continue to warm..." because the contingency ("would") is already stated in the previous sentence, and the relationship stated here is demonstrated elsewhere in the report (i.e., it's not speculative). [Trigg Talley, United States of America]	Not applicable. Headline statement significantly rephrased, warming of climate system no longer mentioned there.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89833	39	4	39	4	change "would" to "will" [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Headline statement significantly rephrased, warming of climate system no long mentioned there.
86599	39	4	39	5	Unclear do we need net zero or net negative CO2 emissions to stabilise the climate? OR are you saying we need either or, depending on ... ? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - These messages have been clarified in the revised Section HS.13
41261	39	4	39	6	There is an important message in this sentence that could be brought out more clearly, as it is policy relevant. My comment is coupled with a note that there was no mention at all of climate emission metrics (GWP, GTP) in the TSM, which felt surprising given their utility in UNFCCC, and other (e.g. Kigali and national) policymaking. This sentence implicitly emphasizes that conversion of non-CO2 forcing (strictly SLCF forcing) to CO2-equivalent emissions using a metric such as GWP and GTP, when emissions are stable or falling, gives a misleading impression. It would imply that their continued emission would cause ADDITIONAL warming (rather than "just", in the case of stable emissions, maintaining their historical contribution to warming). Hence, this could lead to sub-optimal mitigation choices. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - additional information on the implications of achieving net zero GHG emissions with GWP-100 has been included in the revised draft.
42285	39	4	39	6	D1: L4-6 difficult to read with double "or"-statement. [Tina Christensen, Denmark]	Noted - editorial
41349	39	4	39	6	Combining net-zero CO2 with a stabilisation in net non-CO2 forcing wouldn't be enough to meet the Paris Agreement. "Stabilisation" of net non-CO2 forcing has to be removed (see subsection D1.3)! [Alexander Nauels, Germany]	Taken into account - the message have been carefully redrafted into the revised section HS.13
87003	39	4	39	6	By when? Is it the timeline referred to in the Paris Agreement? [Oyvind Christophersen, Norway]	Taken into account. Headline statement significantly rephrased, no timeline required anymore.
10219	39	4	39	7	"would" -> "will" [Robert Kopp, United States of America]	Not applicable. Headline statement significantly rephrased, warming of climate system no long mentioned there.
12673	39	4	39	9	This is not true for most ocean and cryosphere changes. [Lijing Cheng, China]	Taken into account. Headline statement significantly rephrased, warming of climate system no longer mentioned there. note that long-term effect of past and current warming is covered in HS9.
81433	39	4			It would perhaps be more meaningful to quantify the emission reduction range required by say 2030 and 2050 to be consistent with Paris. It would be really useful to add that to table SPM.3 as well. The information is inherent in BOX SPM.2 Figure 1. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - this information is only assessed in WG3
17527	39	4			will' rather than 'would'. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We now say 'requires'.
87467	39	5	39	5	Comma before 'combined' [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
9755	39	6	39	6	"aerosol precursor emissions" is quite a technical term for the SPM and might benefit from an explanation [Jonathan Lynn, Switzerland]	Taken into account. This term no longer features in the revised headline statement (now HS13), which is much shorter.
131827	39	6	39	6	consider eacplaining "non-CO2 forcing" or provide example. [Hans Poertner and WGII TSU, Germany]	Taken into account, non-CO2 are explained in figure SPM2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37663	39	6	39	8	It might sound like additional warming by aerosol reduction "should be" compensated by reduction in methane and other ozone precursors. [Masahide Kimoto, Japan]	Taken into account - the statement was changed to describe more objectively the evolution of the forcer contributions in scenarios, avoiding the policy prescriptiveness
69423	39	6	39	8	This sentence is cited from "Reduction in aerosols and non-methane ozone precursors to improve air quality but without simultaneous stringent CO2 mitigation would lead to additional near-term warming" in Chapter 6. However, some slight alterations (especially, adding "which could be lowered by reducing methane and other ozone precursors simultaneously") in SPM make this sentence unclear. It would be better to use the same sentences in the chapter. [Kaoru Magosaki, Japan]	Taken into account. This part has been removed from the revised headline statement (HS13) to sharpen the it and focus on what's most relevant to policy-makers.
38973	39	6	39	8	What does the "which" refer to? And can you say anything about the effect in the longer term to avoid misinterpretation? How does the warming effect of these aerosols relate to the effect of CO2 emissions that - I suspect - are connected to the aerosol emissions? [Maike Nicolai, Germany]	Not applicable. 'which' removed from revised headline statement (HS13)
38295	39	6	39	8	Many studies have indicated that the simultaneous reduction of methane and other ozone precursors cannot offset the increase in temperature caused by air quality improvement. In this regard it is suggested to verify and modify this statement and delete "which could be lowered by reducing methane and other ozone precursors simultaneously" so as not to mislead the decision. Reference: Dang, R., & Liao, H. (2019). Radiative forcing and health impact of aerosols and ozone in China as the consequence of clean air actions over 2012–2017. Geophysical Research Letters, 46, https://doi.org/10.1029/2019GL084605 [Yaming LIU, China]	Taken into account, the statement D1.7 in the final SPM now mentions that climate effect of methane and aerosols partially counterbalance each other.
77081	39	11	39	20	This paragraph could be expressed in a shorter and much clearer manner [Emer Griffin, Ireland]	Taken into account - The paragraph was clarified, edited down and included in HS.13.1. This particular information was not retained.
104249	39	11	39	20	Recommend to include some explanation why it is possible to ignore non-CO2 effects in these budgets, while several statements afterwards talk about the role of short lived components. [Philippe Tulkens, Belgium]	Taken into account - this is included in the footnote of Table SPM.2
54703	39	11	39	20	Missing from this paragraph about stabilizing global warming is a confirmation of a key message from the AR5 that even after emissions are zeroed, global temperature will remain at about peak levels for many centuries to millennia. This has been a powerful communication message about the long term commitment of global warming. Strongly recommend reiterating this result before providing details about small (few tenths of a degree up or down) changes in global temperature after emissions are zeroed and the potential for global net CDR to significantly lower global temperature. [Nancy Hamzawi, Canada]	Taken into account - Due to space constraints this message was not taken up as an explicit message in the revised draft.
5307	39	11	39	20	I like that in this section the most important bullet is first. It would be still more effective if the bullet was shorter. Perhaps delete the low confidence sentence "Global temperature...are reached"? [Daniel Murphy, United States of America]	Accepted - the bullet has been edited for clarity with its messages included in HS.13.1
8187	39	11	39	20	Recommend to include some explanation why it is possible to ignore non-CO2 effects in these budget- while several statements afterwards talk about the role of short lived components. [Frank Dentener, Italy]	Taken into account - this is included in the footnote of Table SPM.2

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25963	39	12	39	12	We would like to clarify whether "global mean temperature" refers to GSAT. [Don Alfonso Pino Maeso, Spain]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
97411	39	12	39	12	If the contributions to uncertainties given in Table SPM.3 are additive, the total uncertainty is of the order of the remaining budgets for up to 2°C. Hence the budgets seem not suitable to quantify mitigation requirements (GHG emissions reductions). C-budgets can be used to estimate the order of magnitude and the associated time left to reach a certain level of warming for a certain level of warming. To avoid misunderstandings of its statements the IPCC should avoid suggesting accuracy beyond that which is actually available. [Nicole Wilke, Germany]	Taken into account - The uncertainties are not additive. The table has been further condensed and clarified.
9549	39	13	39	14	Need to specifically state the timeframe when net zero emissions need to be achieved to Paris Agreement targets, and the likely committed warming after theoretical stabilisation of emissions and/or CO2 removal. [Joelle Joelle Gergis, Australia]	Rejected - that timeframe depends on how emissions are used over time, which is not assessed in WG1
104251	39	14	39	14	Consider replacing "stabilise warming" with "stabilise GSAT" or "stabilise global warming level". Warming is a process of increasing temperature, and stabilising it suggests continued warming. [Philippe Tulkens, Belgium]	Taken into account. HS13.1 now says 'stabilizing human-induced global temperature increase at any level'.
25965	39	16	39	16	We would like to clarify whether "global temperature" refers to GSAT. [Don Alfonso Pino Maeso, Spain]	The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
28041	39	16	39	16	Please replace "can" by "may". [Eric Brun, France]	Noted - editorial
77083	39	16	39	17	Is this due to natural variability or not? [Emer Griffin, Ireland]	Not due to natural variability. However, this information was not retained in the revised draft.
80167	39	16	39	18	The sign of change after net zero emission is clear and positive as the net effects take place after a delay and until then it is positive temperature change. [Lilian Fejes, Hungary]	Noted - unclear what change is intended
97413	39	16	39	18	Please explain in the SPM in which way and why the assessment of zero-emission warming commitment changed since the AR5 and the SR1.5. [Nicole Wilke, Germany]	Rejected - due to space limitations this information was not included in the revised draft
36271	39	16			Per your own statement in the headline here, you should note that there there is an offset due to non-CO2 GHG, but given that offset (which may vary with SSP), the CO2 cumulative approach for climate change is correct. [Michael PRATHER, United States of America]	Taken into account - the non-CO2 contributions are now highlighted in HS.13.2 and Table SPM.2 (footnote)
77085	39	18	39	20	Some indication of the scale of CO2 removals should be provided or a method to determine the scale and over what timeline? [Emer Griffin, Ireland]	Rejected - WG1 does not provide an assessment of the scale of CO2 removals

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
107503	39	18	39	21	There is much theory, but no observations that net CO2 removal would significantly lower temperature levels. To state with "high confidence" that lowering temperature levels would require CO2 removal is to imply that it would work. Statement should read "Reverting global warming to significantly lower temperature levels once it has exceeded a specific temperature limit would only be possible through global net CO2 removal (high confidence) and there are no observations to show it would be effective (high confidence)." [Hunter Cutting, United States of America]	Taken into account - the statement has been carefully re-evaluated in light of the available evidence, as now reflected in the revised HS.13.4
39891	39	19	39	20	"would require global net CO2 removal at as scale that currently does not exist." Otherwise, it sounds like this is an existing policy option. [TSU WGI, France]	Rejected - no future scenario "currently exists"
28043	39	20	39	20	It is necessary to recall here that even with net zero emission or global net CO2 removal, some effects would last and continue to rise for centuries and millennia especially the rise of sea level. [Eric Brun, France]	Accepted - See HS.13.6
87353	39	22	39	25	There is a need to add information/figures on how and why budgets have changed since AR5 (not just refer to a table) [Marcel Berk, Netherlands]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
44885	39	22	39	25	The first sentence could be omitted, for brevity. Relation to SR1.5 follows in the rest of the D1.2. [Markku Rummukainen, Sweden]	Taken into account. HS13.3 (on carbon budget) is shorter than D1.2.
97415	39	22	39	34	Why and by how much did the values for the C-budget change in comparison to AR5 and to SR1.5? The values provided in Table SPM.3 seem to be different from SR1.5 (3 years later, i.e. should be about 120 Gt CO2 less). [Nicole Wilke, Germany]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
77087	39	22	39	35	Science is expected to advance. This should be reflected in clarity including on the carbon budgets (total and remaining). This information should be provided in a clear and accessible manner. AR5 data can be addressed earlier. [Emer Griffin, Ireland]	Accepted - this is captured in HS.13.3
77089	39	22	39	35	Clarity on the what factors impact the carbon budget with and without feedback would be useful. In essence the nonCO2 ghg reduces the available carbon budget, but by how much? [Emer Griffin, Ireland]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
78647	39	22	39	35	There are multiple aspects to remaining carbon budget assessment (parallels the GMST-GSAT discussion). We have (a) new methodology since AR5; (b) new data (i.e. CMIP6 models); (c) the world has moved on (in this case continued emitting carbon). Can we present them here in a logical sequence like that – possibly even a schematic like the GMST/GSAT one which quantifies the impact of each term. The new methodology has increased our assessment of remaining budget but this hides the fact we've emitted 250-300 GtCO2 since AR5... We should be clear here that while the new assessment might be "good news" the clock is still ticking and the change in methodology doesn't change the fact we've continued to grow emissions since AR5 when we need to be reducing them (I realise we can't say it in those terms). [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - such a schematic sequence goes beyond the synthetic nature of information desired in the SPM.
104253	39	22	39	35	Section D. One of the main carbon budget changes compared to SR1.5 is the choice to include a best estimate of Earth system feedbacks within the budget, rather than leave it outside as in SR1.5. This should be noted in the SPM for transparency. [Philippe Tulkens, Belgium]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
104255	39	22	39	35	The paragraph D.1.2 lacks of figures and explanations about the Earth system feedbacks. Concrete examples, with magnitudes and ranges of uncertainty, should be provided. [Philippe Tulkens, Belgium]	Rejected - due to space limitations only a concise statement on these aspects could be included

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17531	39	22	39	35	This paragraph talks about remaining carbon budget estimates having been updated in SR15, it talks about the factors that affect these budgets but the critical question is: are they in line with what has been given previously? To a non-specialist, the answer to this isn't clear from several readings of this paragraph. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
130251	39	22	39	35	Could probably be reduced to 1-2 sentences. [Trigg Talley, United States of America]	Taken into account. HS13.3 (on carbon budget) is shorter than D1.2.
50391	39	22	39	35	D.1.2 notes the low confidence in earth system feedbacks - suggest this is also linked back to earlier statements about higher accuracy of projections and also what this means when combined with the progress on ECS. The stats in this section will quickly become out of date so it would be helpful to flag to the reader sources such as the UNEP gap report. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - it is not standard practice to refer to evidence that is not assessed within the underlying chapters in the SPM.
90217	39	22	40	8	Carbon budgets are a very useful tool in the framework of the goals set up in the Paris Agreement and will be an important input to its Global Stocktake. We also appreciate the fact that the SPM includes several budgets for several levels of warming and their uncertainty. However, we would like the authors to reassess these carbon budgets in the framework of our comments on the temperature re-assessment in the AR6. In particular, we would like to see if the 0.2°C difference in temperature assessment between AR5, SR1.5 and AR6 explains the 100Gt CO2 smaller budget compared to previous reports. Furthermore, how does this relates to the temperature assessment which was the basis of the Paris Agreement and the how do the temperatures in this table related to the temperature goal of the Paris Agreement? A summary of the discussion of the impact of this re-assessment on the Paris Agreement temperature targets, which is done in subsection 2.3.1.1.3 should be included here. [Georges Gehl, Luxembourg]	Rejected - this level of detail surpasses the intended synthesis that the SPM should provide
77611	39	23	39	25	This sentence could be supported by more detail. [Emer Griffin, Ireland]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
37665	39	24	39	24	It is desirable to point to the place in the report where it is explained in plain words how changes in carbon budget estimate are reached. A fairly large change from one assessment report to another might invoke skepticism about their trustability. [Masahide Kimoto, Japan]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
50393	39	24	39	24	It would be helpful to briefly state the reason(s) here for why the SR1.5 carbon budget estimates were 'larger', as the median ECS is still the same, even though the range shifts up slightly. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - These are included in HS.13.3, with further information available in the underlying report
53519	39	24			replace magnitude by components here since this improved understanding does not necessarily lead to more constrained estimates? [Hervé Douville, France]	Taken into account. the text has been rewritten.
36273	39	24			their magnitude' seems to refer to the subject 'carbon budget estimates'. This is confusing, possibly magnitude should be plural, and budget estimates are both positive and negative. So please rewrite this. If 'carbon budget' is code for total cumulative CO2 then please define carefully before this and use it. It would be better to use an acronym to avoid confusion with the dictionary definition of carbon & budget. [Michael PRATHER, United States of America]	Taken into account. the text has been rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23417	39	25	39	27	Does this sentence really need the medium confidence level? (is it not just a statement of fact?) What does the medium confidence refer to in the sentence? To wheather or not the several factors presented affect the precise value? [Anna Amelia Sörensson, Argentina]	Accepted
66437	39	27	39	29	Do we need to reconcile this statement of "very low confidence" with the statement of "low confidence" on page 25 lines 49-50? It seems like these are talking about the same thing? [Charles Koven, United States of America]	Taken into account - the statement in this section speaks to Earth system feedback more broadly than permafrost only, some of which are even more uncertain.
38975	39	27	39	34	Suggestion to shorten and simplify these sentences: "Compared to SR1.5, the effect of additional Earth system feedbacks has been assessed in more detail. Despite remaining uncertainties, none of these feedbacks contradicts the geophysical requirement that global CO2 emissions have to at least reach net-zero levels to halt warming. The feedbacks are related to factors that can affect future climate hazards. They increase with each increment in additional global warming and the challenge of limiting it to specific temperature thresholds." [Maike Nicolai, Germany]	Taken into account - These are included in HS.13.1-3, with further information available in the underlying report
93627	39	27	39	34	This second half of section D.1.2 is quite long for information that is not very useful as its level of confidence is low. It should be greatly reduced. As section D.1 does not give any indication on the evolution of emission reductions over time, this aspect could be addressed here. For example it could be mentioned how long it would take to reach the remain carbon limit according to different scenarios. [Jean-Louis Dufresne, France]	Taken into account - These are included in HS.13.1-3, with further information available in the underlying report
50395	39	28	39	28	very low confidence' - is this because the models don't agree on the exact magnitude of contribution from additional earth system feedbacks, or due to a lack of obs, or both? If ESMs are showing things and simpler climate models aren't, it would be useful to at least tease this out. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - there is no space for such discussion at the level of the SPM.
77613	39	28	39	30	they scale with each increment' not clear what this means [Emer Griffin, Ireland]	Noted - these messages have been edited further for clarity
42373	39	29	39	32	Important message. [Tina Christensen, Denmark]	Noted
25967	39	29	39	34	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed for statements of facts or when quantified uncertainties are provided.
9551	39	31	39	31	Reach net-zero by when? Policy makers need specifics. People need to know where the world is tracking right now and how far away we are from overshooting Paris Agreement targets and what our realistic warming trajectory is. [Joelle Joelle Gergis, Australia]	Rejected - The timing of net zero is assessed as part of mitigation pathways in WG3
28045	39	31	39	32	As uncertainties appear in the begining of this sentence, it seems necessary to add between "factors that affect" and "future climate hazards": "projections on". Indeed, uncertainties are not factors that affect future climate hazards. Only feedbacks do. Otherwise, "and their uncertainties" should be delated. [Eric Brun, France]	Noted - this information was not retained in the revised draft of the SPM
23419	39	31	39	34	The writing can be improved. What scale? The feedbacks? The hazards? [Anna Amelia Sörensson, Argentina]	Noted - these messages have been edited further for clarity
36275	39	31			This statement or equivalent is made several times here. Is this bullet necessary? and if so, make clear what is new here. [Michael PRATHER, United States of America]	Taken into account - messages have been streamlined and condensed throughout the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50397	39	32	39	32	affect future climate hazards and the amount of greenhouse gases that are allowable to likely avoid them.' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted - this information was not retained in the revised draft of the SPM
116123	39		39		A clear statement on the (lack of climate) effect of a temporary reduction in emissions (if there is no long term decline) would be welcome in the COVID19 context. [Valerie Masson-Delmotte, France]	Accepted. HS14.1 is about COVID19.
17529	39				It might be helpful to policymakers to reference current NDCs here, giving our current pathway. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. It is beyond the mandate of WGI to assess the current NDCs in the Context of the Paris Agreement
111799	40	1	40	7	The table should explicitly include the starting year for the "remaining carbon budget" (probably 2020). If not, this will lead to confusion and ongoing questions [Oliver Geden, Germany]	Accepted
87307	40	1	40	8	Tabel SPM.3: may be difficult to understand for nont-technical policymakers. As the notion of a remaning carbon budget has become quite important as well as confusing for policy making since SR1.5, suggest to take up some help with interpreting this table in the footnotes, while using simple language. [Marcel Berk, Netherlands]	Rejected - because of space constraints no such explanations could be added
80169	40	1	40	8	Table: 1) The period mentioned here is newer than the one in previous paragraphs and figures and tables (not 2009-2018). Previously it was also mentioned global surface air temperature, without average. 2) It cannot be deducted from the numbers whether the uncertainties are reflected in the median or different percentile values of the remaining carbon budget or it is added on the top of them. If the latter so then the uncertainty is almost larger with an order of magnitude. 3) There might be some unknown, not yet discussed definitions in this table which is also not discussed in the respective texts. Could be simplified maybe. [Lilian Fejes, Hungary]	Taken into account - the technical information is available in the TS and the underlying chapters. The time period has now been made consistent with other projections, and definitions are explained.
69425	40	1	40	8	Table SPM.3; There is a sharp decrease in the carbon budget described in the previous report (SR1.5) and the budget shown in this draft (table SPM.3). For example, while SR1.5 indicated 1170 GtCO ₂ remaining for staying below 2.0°C with 67% certainty from the 1850-1900 level, this draft SPM shows 960 GtCO ₂ remaining for the same category, which is 210 GtCO ₂ lower than SR1.5. Given that the global CO ₂ emissions for the last couple of years amounted to approximately 40 GtCO ₂ per year, this decrease is large in comparison. The footnote (4) in the Table SPM.3 specifically mentions that "the future evolution of non-CO ₂ emissions in mitigation scenarios reaching net zero CO ₂ emissions ...will be assessed explicitly in the AR6 Working Group III report." As such, with the understanding that the contents in this Table SPM.3 will be assessed further and in its entirety in the WGIII report and later in the AR6/Synthesis Report, it would be requested that for the SPM of the WGI Report, the respective uncertainty for each scenario in Table SPM.3 as well as the factors that contributed to the difference from the values described in the SR1.5 are clearly stated. In order to avoid confusion and remain policy-relevant, the Table would merit to be remarked appropriately with the factors affecting the assessment at this juncture of the AR6 cycle. [Kaoru Magosaki, Japan]	Accepted - included in HS.13.3

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17725	40	1	40	8	Table SPM.3 is an important table that probably could be made easier for policymakers if it is explained a bit more how it can be used to support decisions. To change the name of the columns might simplify the understanding as well. [Anette Jönsson, Sweden]	Noted, we have tried to improve the labelling of the table (now table SPM.2).
44887	40	1	40	8	What do the ranges under "key uncertainties and variations" encompass, e.g. the +/- 250 GtCO ₂ ? Min-max? Some probability range? Consider also using clearer and uniform expressions. For example, +/-100% one std is a bit complicated expression. Using the same kind of expression for all entries would add clarity. [Markku Rummukainen, Sweden]	Taken into account - The table was further simplified.
80473	40	1	40	8	Tabel SPM.3: may be difficult to understand for nont-technical policymakers. As the notion of a remaining carbon budget has become quite important as well as confusing for policy making since SR1.5, suggest to take up some help with interpreting this table in the footnotes, while using in simple language. [Leo Meyer, Netherlands]	Rejected - because of space constraints no such explanations could be added
78979	40	1	40	8	Table SPM3 : It is important to keep the information about carbon budgets in a way that is comparable to AR5 and SR15. Carbon budgets are an important concept for the GST of the Paris Agreement, and the Paris Agreement could only refer to global mean temperature as it was defined in AR5, not to further refinements of the concept. If a new method for calculating past warming is needed, it is important to also include the carbon budget calculated with both the AR5 and SR15 methods (the SR15 method implies that past warming above pre-industrial was about 1.0°C around 2017, as indicated in SR15's SPM, not 1.1°C by 2010-2019). [Martine Vanderstraeten, Belgium]	Accepted - included in HS.13.3
86491	40	1	40	8	Table SPM3 - this is a very important table, but easily understandable. Is the temperature increase in the first column by 2100 since 2010-2019? And what is 'global average surface air temperature'? Is it GSAT? Please be consistent with using terms [Ala Taimar, Estonia]	Taken into account - the table was further edited for clarity
130253	40	1			Policymakers will not understand this table. A little more discussion of its particulars in D.1.2 would help. [Trigg Talley, United States of America]	Taken into account - explanations added in HS.13.1-3
86149	40	3	40	3	Table: This is very useful information. Please move column "Approx. warming since 1850-1900" to appear first, as this is the most relevant measure. The "Additional warming since 2010-2019" column could even be removed. - It would also help to include a column showing current annual emissions, as useful comparison (and even converting the budget into years remaining, at current emission rate. So if emissions in 2018 were 37, the remaining budget of 310 for a 2 in 3 chance of staying below 1.5, corresponds to 8 years at current emissions rate, or 6 years from 2020 onward. This would be extremely useful for communication purposes.). - 33rd, 50th, 67th should be explained. - the Key uncertainties are very hard to understand in the current format. Are they fixed amounts, that do not vary with 33rd-67th confidence? Can they be incorporated into table? Along with how many years this adds/takes off the budget at today's emission rate (e.g. at today's emissions the first key uncertainty could add/subtract nearly 7 years). This would be very useful to help visualise these highly important numbers. - The notes and footnotes are also a bit confusing. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account / accepted - the current annual emissions are not assessed in WG1, but could be integrated at the level of the synthesis report. The table has been further simplified for clarity.
8185	40	3	40	3	Recommend to have also entries for 3 and 4 degrees temperature increase since preindustrial [Frank Dentener, Italy]	Rejected - the table remains to focus on a limited number of temperature levels that link to temperature levels and goals discussed in international policy.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
117247	40	3	40	3	footnote 1: rest of the report uses the period 1850-1900 to 2009-2018 for assessing GSAT (B.2.1) ! Not 2010-2019. [Maisa Rojas, Chile]	Taken into account - the use of reference periods has been carefully reassessed throughout the SPM.
130255	40	3	40	5	The Table SPM.3caption is insufficient. Enhance the description so that a reader does not need to go to the underlying chapter to understand the meaning/purpose of the table. [Trigg Talley, United States of America]	Rejected - For conciseness, the caption of the table is kept short.
112607	40	3	40	5	Calculating carbon budgets from 2020 for warming relative to 2015 (average 2010-2019) is confusing even if corrected for by subtracting observed emissions for the past 5 years. This may be coherent for the 50th percentile, but becomes rather convoluted for other percentiles, because to do it properly, we would need to take into account uncertainty in warming over that 5 year period as well. And it is very confusing having one table SPM.3 giving carbon budgets from 2020 (although you have to read the fine print rather carefully to work this out) and another (Box SPM2, Table 3) with carbon budgets from 2015. Why not just do everything from 2020? [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the limiting factor is the provision of an estimate of human-induced warming for the year 2020, which is not available in the underlying report. It is only available for the 2010-2019 period.
78285	40	3	40	6	Useful to state the timescale of the warming in the second column, i.e. by what year (e.g. 2100) [Leonie Lee, Singapore]	Rejected - the assessment does not provide such a precise cut-off date.
15393	40	3	40	7	Table SPM.3 and related descriptions in D.1.1 and D.1.2 as well as in Chapter 5 should be more thoroughly treated in Synthesis Report and may be deleted from the WGI report. The reason is that the remaining carbon budget is affected by non-CO2 scenarios, and we have to wait for WGIII scenario assessment about non-CO2 warming contributions. I notice Footnote (4) attached in Table SPM.3 on this matter, but it gives an impression that the table is still premature. Remaining carbon budget in WGI should be assessed in such a way that CO2-induced and non-CO2-induced warming contributions are explicitly described, not in a combined way as in SR15. In this regard, the right panel of Figure 5.31 is helpful for understanding complex issues and worth of being presented in SPM. [Junichi Tsutsui, Japan]	Noted but we have decided to keep the table because this information is policy-relevant and the table was supported by other reviewers.
69427	40	3	40	7	The values of the remaining carbon budget are greatly reduced in this table, compared to those in the SR1.5 (Table 2.2). The difference could not be accounted for by that in the base period (2010-19 in AR6 vs 2005-2016 in SR1.5). It is requested that the most important factors for this difference (e.g. the use of GSAT instead of GMST) is accounted for. [Kaoru Magosaki, Japan]	Accepted - included in HS.13.3
104257	40	3	40	7	Recommend to have also entries for 3 and 4 degrees temperature increase since preindustrial [Philippe Tulkens, Belgium]	Rejected - due to space limitation and the intention to be concise, the table focuses on values up to 2°C
78663	40	3	40	7	Sorry, but I do not understand this table. Warming since 2010-2019 (°C) should be a fixed number - so "additional" means that there would have been more - but under which circumstances? That we would have used more than we did - but how is that related to "remaining carbon budget"? Sorry, not clear to me. (Same for second column, and basically all of the table.) [Heike Wex, Germany]	Taken into account - The table was further simplified.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97417	40	3	40	7	Given the huge uncertainties that are larger than the budget themselves it is not helpful to provide budgets in steps of 0.1C. On the contrary, such granularity suggests undue accuracy of the budgets. Please provide numbers only for 1.5 and 2 degree warming since preindustrial. Please add a figure that conveys the uncertainties provided in the table. Please explain in more detail why budgets for higher levels of warming do not make sense. Also highlight that these budgets are only valid for rising temperature, but not for reducing the temperature in overshoot scenarios, where the budget might be much larger. Please see also our comment on the Entire Report regarding the accuracy of quantitative information. [Nicole Wilke, Germany]	Accepted - the table has been further condensed for clarity. The additional clarifications could not be added due to space constraints.
81039	40	3	40	7	Although the reader can add up the first two columns, I would suggest to add a new column which show the total temperature change that the budget refers to (column 1 + 2). [canadell pep, Australia]	Accepted - the table has been further condensed for clarity, with a focus on total temperature now.
130257	40	3	40	7	This is an interesting and useful table, but two key pieces of information should be prominently included: (1) current emissions per year (to give folks a sense of how many years of current emissions are left), and (2) current observed warming to date (it is implied by the first row that this would be 1.1°C, but elsewhere it's listed as 0.8C or 0.9°C). Be sure there is internal consistency across the report in what the observed warming is. [Trigg Talley, United States of America]	Taken into account - Current annual emissions are not assessed in the WG1 report, but can be integrated at the stage of the SyR. The current observed anthropogenic warming is included.
131829	40	3	40	7	This table is way to complex for non-expert to understand. Could you give some guidance on how to read it underneath the table or in a footnote? What does the last three columns mean:per percentiles of TCRE? The information compiled in this table is way too important to present in a way that only scientists can translate it. [Hans Poertner and WGII TSU, Germany]	Accepted - the table has been further condensed for clarity.
87197	40	3	40	8	Table SPM3: It would be useful to explain what these percentiles (33rd, 50th and 67th) mean, and also why exactly these are chosen. Please also consider a different annotation for footnotes than *(1) etc. as this makes the table quite hard to read. In addition, please check for consistency between the contribution from permafrost thawing (135 GtCO ₂ reduction per C of additional warming) described in footnote 2 and the amount described in para C2.2 p.25 (74 +-48 GtCO ₂ per degree of global warming by 2100. [Oyvind Christophersen, Norway]	Taken into account - the caption highlights that the carbon budgets are given for various percentiles of TCRE. The Earth system feedback impact has been made consistent with the underlying assessment.
29433	40	3	40	8	From a policymaker point of view, the core message of Table SPM.3 might be a bit hard to understand. [Joachim Fallmann, Germany]	Taken into account, we have tried to improve the labelling and layout of the table (now table SPM.2).
14573	40	3	40	11	Table SPM3 seems very technical. Is this useful to and understandable by the average policy maker? [Roshanka Ranasinghe, Netherlands]	Government review comments suggest it is.
86601	40	3			Table SPM3. Several issues here 1) baseline for present-day warming is 2010-2019 here while it's 2009-2018 in the rest of the SPM. 2) Why are earth system feedbacks assessed to be 135GtCO ₂ /degree. The assessed permafrost feedback is 74GtCO ₂ /degree (section C.2.2) ? 3) I would strongly suggest NOT to include these ESM feedbacks in the numbers provided in the table. They operate on very long time scales and hence make the simple estimate of remaining years (assuming current emission) not valid anymore. I would mention them as additional source of carbon as was done in SR1.5. 3) Why are these numbers not consistent with Box2 Table 3 and why do we need both anyway? 4) Is it really needed to show 0.1°C increments as opposed to values for 1.5, 2, 2.5 and 3°C for example? [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - periods in the table are made consistent with the rest of the SPM. Earth system feedbacks have been updated consistent with the underlying assessment. The number of increments has been reduced.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41351	40	3			Table SPM.3: 1850-1900 would not meet the strict definition of pre-industrial. Please add at least an asterisk that allows to add historical warming for the period 1750 to 1850-1900, as done in section B2.1: "The net increase of global surface air temperature (GSAT) caused by anthropogenic factors between 1750 and 1850-1900 is likely -0.1 to 0.2°C (medium confidence)." [Alexander Nauels, Germany]	Taken into account - the table now refers to the reference period only, without given this period an additional label
28047	40	3			Regarding Table SPM.3: The choice of the warming levels (1.3 to 2.1°C since 1850-1900 with a 0.1°C increment) is very surprising. So small increments do not provide a strong added-value. Instead, we recommend to choose warming levels from 1.5°C to 5°C with a 0.5°C increment. It would be much more informative for policy-makers and more consistent with the projections associated with the different SSPs. In addition, we propose to add the value "1,75°C" (still since 1850-1900). We also suggest to delete the first column "Additionnal warming since 2010-2019". We propose to write in bold and in the text above the specific values for 1,5°C and 2°C of warming. Finally, in footnote 6, we suggest at least to change "EgC" with "1000 PgC" to ensure the consistency with the units used in C1.4. Consistently with the comments made in C1.4, we have a strong preference for using the unit "°C per 1000" GT CO2 instead of °C per 1000 PgC plus a footnote. Indeed GT CO2 is a quite common unit for annual emissions and the link between cumulative emissions and annual emissions is easier if this unit is also used for cumulative emissions. [Eric Brun, France]	Accepted - the table has been further condensed for clarity.
36277	40	3			Table SPM.3 is quite clear. In fact the discussion of non-CO2 forcing should go into the scenario table at the beginning (Box SPM.2 Table 3). [Michael PRATHER, United States of America]	Taken into account - as the table continues to focus on CO2, the clarification is kept in the footnote for now.
108203	40	6	40	6	The content of this table would be more effectively presented as a data visualization product. [Anton Holland, Canada]	Noted - but unfortunately insufficient time was available to create such a data visualisation from scratch
50401	40	6	40	6	Assuming the TCRE distribution is the only thing normally referred to in talking about the 'percentage chance for limiting global warming to a given level', it would be better to refer to that in place of 'per percentile of TCRE' which would be less well understood by a policymaker. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - the caption continues to refer to the scientifically accurate description, while other, simpler wording can be used in outreach.
112615	40	6	40	6	After footnote (1), insert "The corresponding assessed increase in global temperature using the definitions and datasets used in AR5 would have been 0.9C." This is important information for many governments, since it is acknowledged (Chapter 2, page 40, lines 6-17) that the targets in the PA were "predicated on the assumption of 0.85°C by 2012". [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - this information is assessed and presented elsewhere in the SPM.
10221	40	6	40	6	Need a punchline implication of the sum of different sources of uncertainty for the budget. Should TCRE distribution uncertainty be included in the bullets, given that it is already represented in the table columns? [Robert Kopp, United States of America]	Noted - editorial rather than substance
50519	40	6	40	7	Table SPM.3 presents emissions in units of GtCO2, but Chapter 5 uses PgC. Please be consistent or provide information on converting between these different units. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - the chapter now also includes GtCO2 values
44913	40	6	40	7	It would seem more logical to have "warming since 1850-1900" in column one, and then "the additional warming" in column two. [Markku Rummukainen, Sweden]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50409	40	6	40	7	It wasn't clear to me why so many rows are needed in this table for SPM purpose? Also, the first column seems confusing when the Paris Agreement goals are framed in terms of the information in the second column. I'd suggest including the full table in the relevant chapter, but a simplified version in the SPM (i.e. just two rows for 1.5 and 2.0 degrees scenarios and dropping column 1)? Also, the present array of definitional footnotes seem very detailed for SPM material? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - the table has been further condensed for clarity.
28049	40	11	40	11	Please replace "consistent with the Paris Agreement" by "consistent with the long-term temperature goals of the Paris Agreement". [Eric Brun, France]	Not applicable, the Paris agreement is not mentioned in the final version
77091	40	11	40	12	Can this statement be explained? Long term warming is determined by CO2 makes addressing these emissions essential, how does addressing the other GHGs complement this? [Emer Griffin, Ireland]	Taken into account in the final D1 statement. The additional effect on temperatures of other GHGs compared with the effect of CO2 is shown in figure SPM4 of the final SPM version. The potential range around the estimated remaining carbon budgets due to higher or lower reductions in non-CO2 is also provided in Table SPM2 of the SPM.
25969	40	11	40	14	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed for statements of facts or when quantified uncertainties are provided.
9757	40	11	40	16	sorry for the scientific illiteracy, but maybe it needs to be spelled out that the aerosols and other precursors don't add to warming but on the contrary reduce it when they increase. Given the context of the whole report and this section many non-specialists might counter-intuitively suppose that aerosols are another kind of GHG and so reducing them would help address warming. see previous comment [Jonathan Lynn, Switzerland]	Taken into account, the figure SPM2 in the final SPM show effect on temperature of individual component. The cooling effect of aerosol is also mentioned in A.4.1.
104259	40	11	40	20	It would be useful to comment on spatial heterogeneity. Local reductions of well-mixed gases (CO, CH4) can be associated with global temperature. To what extent is the same true for black carbon and aerosols? [Philippe Tulkens, Belgium]	Rejected, the SPM can not cover all the details explained in the chapters.
104261	40	11	40	20	The paragraph D.1.3 should provide more detailed information about the different non-CO2 GHG, including NO2, in addition to the current information about methane and black carbon. [Philippe Tulkens, Belgium]	Rejected, the SPM can not cover all the details explained in the chapters but detailed effects of emissions of individual components is visible on Figure SPM2.
44915	40	11	40	20	The importance of SLCFs is discussed here in a time frame until 2040, which also is an important period. Still, it would be interesting to also highlight, as appropriate, the period beyond 2040 and into the second half of the century. What applies on such longer-term (for SLCFs other than those discussed in D1.4)? [Markku Rummukainen, Sweden]	Taken into account. The revised version (D1.7) also mentions the long term effect of SLCF in the 5 illustrative scenario
97419	40	11	40	20	This subsection is confusing regarding the implications of reducing different types of SLCF. It would be useful to first explain which of the SLCF is warming or cooling, how they are linked to air quality and decarbonisation measures. It is important to explain the different time scales these forcing agents are acting on. Once this background is clear, it will be straightforward to explain their role for the Paris temperature targets, both in terms of peak and long term warming. Please see also our comments regarding the assessment of emission metrics in Ch7. [Nicole Wilke, Germany]	For sake of conciseness, the SPM can not re-explain all the background. Warming and cooling effects are shown for individual component in figure SPM2 and the short lifetime of methane and aerosols is reminded in the D1.7.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87005	40	11	40	20	We do not understand why only methane and black carbon are mentioned to partially cancel out the increased warming by reduced cooling aerosols (mostly sulfate) in the atmosphere. Reduction in CO2 will have a large impact also in the short term (2040) [e.g. p. 61 l. 31: CO2 emissions also cause an important contribution to near-term warming (Lund et al., submitted) and figure 6.16] and e.g. HFCs would also contribute. Please revise D.1.3 to reflect this. [Oyvind Christophersen, Norway]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
36279	40	11			D.1.3. is clear and well written. [Michael PRATHER, United States of America]	Thank you.
17727	40	12	40	12	Consider including a footnote or similar explaining what is included among the "non-CO2 emissions". [Anette Jönsson, Sweden]	Taken into account, non-CO2 are explained in figure SPM2.
112611	40	12	40	12	It would be great to make this more quantitative: "Anthropogenic warming (DeltaT) over any multi-decade period is determined by the Transient Climate Response to Emissions (TCRE) times the sum of cumulative carbon dioxide emissions (E) over that period plus the change in non-CO2 radiative forcing (DeltaF) divided by the radiative forcing per tonne of CO2 emitted (alpha): DeltaT = TCRE x (E + DeltaF/alpha). The factor alpha is the Absolute Global Warming Potential of CO2 normalised by the time-horizon, AGWP_H/H. It is approximately constant at 1 W/m2 per TtCO2, but declines slightly with increasing H, which is why non-CO2 radiative forcing must decline slowly to be consistent with net zero carbon dioxide emissions and no further warming. I fear there would be strong resistance to including an equation in the SPM, but it is such a policy-relevant equation, drawing together such well-established concepts, I urge you to think about it. And the great advantage of this equation is that it is true by definition, because this is what we mean by the TCRE and AGWP that apply to that particular period or scenario. Of course, both are to some degree timescale and scenario-dependent, but any such dependence is well within uncertainty due to internal variability. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	For sake of brevity, the suggested equation is not included in the SPM
50405	40	12	40	13	Suggested edit: Many non-CO2 emissions are relatively short-lived climate forcers compared to CO2, and...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
130259	40	12	40	20	The non-expert reader will never link (in this paragraph) that non-CO2 emissions refers to methane and/or black carbon mentioned a few lines below. Suggest clarifying that methane and black carbon are examples of non-CO2 emissions. [Trigg Talley, United States of America]	This paragraph has been revised in D1.7. Clearly states the specific emissions being discussed
131831	40	13	40	13	could you name two or three short-lived climate forcers here? Perhaps in a bracket behind the technical term?or: "...short-lived climate forcers such as methane, ozone and aerosols...." [Hans Poertner and WGII TSU, Germany]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
38977	40	14	40	15	It is hard to understand why a reduction in aerosols and non-methane ozone precursors increases their contribution to warming. Could you please explain or rephrase? [Maïke Nicolai, Germany]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
69429	40	14	40	16	In this sentence, "without stringent CO2 mitigation," which is important information included in the original sentence in Chapter 6 is deleted. This should not be omitted in the SPM. [Kaoru Magosaki, Japan]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
17729	40	14	40	16	Information is missing regarding the effect of reducing aerosols and non-methane ozone precursors after 2040 - will reductions thereafter still lead to an increase in temperature? [Anette Jönsson, Sweden]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
25971	40	14	40	16	It would be useful to complement this sentence with "but without simultaneous stringent CO2 reductions" as it appears in chapter 6, page 6 lines 45-46: "Reductions in aerosols and non-methane ozone precursors to improve air quality but without simultaneous stringent CO2 mitigation would lead to additional near-term warming with a likely range of 0.1-0.2°C". [Don Alfonso Pino Maeso, Spain]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
131833	40	14	40	17	for the uninformed reader, the relationship between SLCF, air quality and global warming needs to be given simply - suggest to use cooling contribution in this sentence [Hans Poertner and WGII TSU, Germany]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
16675	40	15	40	15	This "increase of their warming contribution" is confusing as aerosols cool. It would be better to say "decrease of their cooling contribution". [William Collins, United Kingdom (of Great Britain and Northern Ireland)]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
28051	40	15	40	15	How is it possible to have a specific date in a very broad and not specific sentence? (the reductions in aerosols are not quantified, none in the increase in warming contribution). [Eric Brun, France]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
50407	40	15	40	15	Suggested edit for simplicity: Reductions in aerosols and non-methane ozone precursors to improve air quality would lead to an increased warming by 2040' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
108273	40	15	40	15	This value seems inconsistent with the aerosol ERF assessment (Figure SPM.3, and Chapter 7, Fig. 7.11) that quantifies the effect of 2018 aerosols at 0.6°C, already including BC. [Johannes Quaas, Germany]	Thanks for bringing to our attention. This paragraph was merged together with D4.3 to a more concise D1.7. Consistency between what is said in Chapter 6 and 7 was ensured
104263	40	16	40	17	This sentence on its own does not make sense. Whether or not CH4 reductions can cancel out warming from aerosol reductions depends on the quantity of each reduction, which is not clear from the context. [Philippe Tulkens, Belgium]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
114961	40	16	40	18	Is this still valid in view of new work e.g., https://www.geosci-model-dev-discuss.net/gmd-2019-375/ , and recent aerchemmp simulations? [Zbigniew Klimont, Austria]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
28053	40	17	40	19	According to the figures provided previously, CH4 accounts for about 14% of the total ERF, and we know that anthropogenic methane emissions also need to be strongly decreased to meet the Paris Agreement. But this section seems to consider the need of CH4 emissions cut only by comparison to the additional warming expected from aerosols and non-methane ozone precursors. The need to decrease CH4 emissions anyway should be better highlighted. [Eric Brun, France]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
26179	40	17	40	20	It is not high confidence for black carbon as described in 7.3.3.1.2. The some recent studies indicated that the climate sensitivity parameter of black carbon is much smaller than sulfate. [Toshihiko Takemura, Japan]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
69431	40	19	40	19	The meaning of "specific combustion" is required as this phrase cannot be found in Chapter 6. [Kaoru Magosaki, Japan]	This paragraph has been revised and reflects more clearly the conclusions from Chapter 6 in D1.7
50403	40	Table	40	Table	The remaining carbon budgets (RH three columns): is this assuming that other GHGs are assumed to go down, rise or remain the same? It would be useful to include this detail too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - included in HS.13.2

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
3593	40		40		It will be better to add note explaining that carbon budgets for 1.5 and 2 degree has shrunk from 580GtCO ₂ and 1500GtCO ₂ to 390 to 1140GtCO ₂ respectively based on estimated TCRE of 1.6 degree. This is definitely be the most powerful message to WG3 and policymakers. [Mitsutsune Yamaguchi, Japan]	Taken into account - The values in Table SPM.2 should provide a clear message, while providing further context and comparisons with AR5 are not possible due to space constraints.
116125	40		40		Table SPM3 and related aspects (visual, text) need to provide clarity on changes compared to AR5-SR15. [Valerie Masson-Delmotte, France]	Accepted - included in HS.13.3
17533	40				per percentiles' needs to be further explained. Generally, further work is needed to make the 'Key uncertainties and variations' and many of the footnotes more accessible to non-specialists. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - the table was simplified, and the footnotes edited. They remain, however, quite technical.
130261	41	1	41	5	"...are estimated to lead to a reduction of global warming of less than 0.07°C by 2050 and between 0.2-0.4°C by 2100, compared to projections where HFC emissions continue unregulated. This reduction in warming attributed to HFC regulation results from both substitution of HFCs with alternative lower-warming refrigerants and CO ₂ emissions reductions as a result of energy efficiency improvements in refrigeration and air-conditioning equipment." The first sentence is really difficult to parse and not quite correct. The second sentence is simply not correct; these numbers don't include energy efficiency improvements. See WMO (2018), Chapter 2. Suggested re-write: "The Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer and national regulations limiting emissions from hydrofluorocarbons (HFCs) are estimated to result in HFC contributions to global warming of 0.07°C in 2050 and 0.06°C in 2100, versus 0.1°C in 2050 and 0.3-0.5°C in 2100 absent regulation." From WMO (2018): "Improvements in energy efficiency in refrigeration and air-conditioner equipment during the transition to low-GWP alternative refrigerants can potentially double the climate benefits of the HFC phase-down of the Kigali Amendment." [Trigg Talley, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
68233	41	1	41	8	The avoided warming as stated here is that from the transition away from HFCs to Further, the avoided warming does not consider HFC-23, which is primarily a by-product of producing HCFC-22, and not included in these calculations, although HFC-23 represents 17% of forcing from HFCs in 2016. Future emissions of HFC-23 are expected to be limited now that it is regulated by the Kigali Amendment. See World Meteorological Organization (WMO), United Nations Environment Programme (UNEP), National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), and European Commission (2018). Scientific Assessment of Ozone Depletion: 2018, Global Ozone Research and Monitoring Project-Report No. 58. Geneva, Switzerland. ES.39 ("The 2016 Kigali Amendment to the Montreal Protocol, assuming global compliance, is expected to reduce future radiative forcing due to HFCs by about 50% in 2050 compared to the forcing from HFCs in the baseline scenario. Currently (in 2016), HFCs account for a forcing of 0.025 W m ⁻² not including 0.005 from HFC-23; forcing from these HFCs was projected to increase up to 0.25 W m ⁻² by 2050 (excluding a contribution from HFC-23) with projected increased use and emissions in the absence of controls. With the adoption of the Kigali Amendment, a phasedown schedule has been agreed for HFC production and consumption in developed and developing countries under the Montreal Protocol. With global adherence to this Amendment in combination with national and regional regulations that were already in place in, e.g., Europe, the USA, and Japan, along with additional recent controls in other countries, future radiative forcing from HFCs is projected to reach 0.13 W m ⁻² by 2050 (excluding HFC-23), or about half the forcing projected in the absence of these controls."); and Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Art. 2J, ¶¶ 1–4, 6–7, 15 Oct. 2016, C.N.872.2016.TREATIES-XXVII.2.f U.N.T.S. 2 ("Each country manufacturing HCFC-22 or HFCs shall ensure that starting in 2020 the emissions of HFC-23 generated in production facilities are limited to the extent that the emissions of HFC-23 are not greater than the emissions of HFC-22 in the same facilities.")	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
87199	41	1	41	8	We appreciate and think it is appropriate that a thorough description of the Kigali Amendment is included in the SPM. However, we think that some parts of the current description are in discrepancy with the underlying chapters, and also excludes that there are a clear potential to do even more stringent mitigation efforts with regards to the reduction of HFCs. Especially the last sentence should be reformulated since it is clear from the underlying chapter 6.5.3.3 (p. 66, l. 17-21) that energy efficiency gains has the potential to increase the climate benefits even further. In addition, we encourage you to include ", including natural substances" after "... alternative lower-warming refrigerants" in line 6. This is to highlight that there are both synthetically and natural components (like e.g CO ₂ , Ammonia and Propane) that can be used as refrigerants. [Oyvind Christophersen, Norway]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
66729	41	1	41	8	<p>The avoided warming as stated here is that from the transition away from HFCs to low-GWP refrigerants. Energy efficiency improvements to cooling equipment, which could take places as part of this transition. Policies to improve efficiency of ACs and other cooling equipment can avoid significant emissions as demand for cooling grows. Shah, N., Wei, M., Letschert, V. and Phadke, A. (2019). Benefits of Energy Efficient and Low-Global Warming Potential Refrigerant Cooling Equipment. U.S.A: Lawrence Berkeley National Laboratory (“For best-available-technology (or “maximum” efficiency), total savings to 2050 are 373.0 and 257.6 GtCO₂e for baseline (or static) electricity emission factors and decreasing emission factors, respectively (Fig. 1). Table S1 in the SI shows the GHG emissions for the reference case (no efficiency improvement and baseline HFC refrigerants) vs. the policy case of best-available technology (BAT) energy efficiency and low GWP refrigerants for 2030, 2040, and 2050 with static emission factors for both cases Reference case cumulative GHG emissions are 587.1 Gt CO₂e while the policy case is 214.1 Gt for an overall cumulative savings of 373.0 Gt CO₂e.”); Dreyfus G., et al. (2020) ASSESSMENT OF CLIMATE AND DEVELOPMENT BENEFITS OF EFFICIENT AND CLIMATE-FRIENDLY COOLING, 1 (“However, robust policies that drive the use of best available technologies can cut cumulative emissions from the stationary air conditioning and refrigeration sectors by 38–60 GtCO₂e by 2030, by 130–260 GtCO₂e by 2050, and by 210–460 by 2060, depending on future rates of de- carbonization of electricity generation (Table 3.1). (For comparison, the global annual CO₂ emissions from fossil fuel energy sources in 2018 totalled 33.1 GtCO₂.8) A quarter of the mitigation is from phasing down HFC refrigerants and switching to alternatives with low-GWP, while three-quarters is from ensuring that cooling equipment uses the best available technology to improve energy efficiency and reduce the use of electricity (Table 3.1).”). [Kristin Campbell, United States of America]</p>	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69853	41	1	41	8	Note that the energy efficiency considered here is only associated with the chemical transition. It does not consider emissions reductions associated with improved the efficiency of the equipment. Energy efficiency improvements to cooling equipment historically have been catalyzed by refrigerant transitions under the Montreal Protocol, and in the case of the Kigali Amendment, there are parallel decisions by the Parties promoting energy efficiency, as well as a fast-start fund. Transitioning the best currently available efficiency and refrigerant technologies for stationary air conditioning and refrigeration would cut cumulative emissions by 38–60 GtCO ₂ e by 2030, by 130–260 GtCO ₂ e by 2050, and by 210–460 by 2060, depending on future rates of decarbonization of electricity generation. Shah, N., Wei, M., Letschert, V. and Phadke, A. (2019). Benefits of Energy Efficient and Low-Global Warming Potential Refrigerant Cooling Equipment. U.S.A: Lawrence Berkeley National Laboratory (“For best-available-technology (or “maximum” efficiency), total savings to 2050 are 373.0 and 257.6 GtCO ₂ e for baseline (or static) electricity emission factors and decreasing emission factors, respectively (Fig. 1). Table S1 in the SI shows the GHG emissions for the reference case (no efficiency improvement and baseline HFC refrigerants) vs. the policy case of best-available technology (BAT) energy efficiency and low GWP refrigerants for 2030, 2040, and 2050 with static emission factors for both cases Reference case cumulative GHG emissions are 587.1 Gt CO ₂ e while the policy case is 214.1 Gt for an overall cumulative savings of 373.0 Gt CO ₂ e.”); Dreyfus G., et al. (2020) ASSESSMENT OF CLIMATE AND DEVELOPMENT BENEFITS OF EFFICIENT AND CLIMATE-FRIENDLY COOLING, 1 (“However, robust policies that drive the use of best available technologies can cut cumulative emissions from the stationary air conditioning and refrigeration sectors by 38–60 GtCO ₂ e by 2030, by 130–260 GtCO ₂ e by 2050, and by 210–460 by 2060, depending on future rates of de- carbonization of electricity generation (Table 3.1). (For comparison, the global annual CO ₂ emissions from fossil fuel	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
77093	41	1	41	28	Some statement on synergies with air quality policy is warranted. This could refer to the UNECE CLTRAP and lessons from and links to this process. [Emer Griffin, Ireland]	Taken into account in chapter 6 which took into account the scientific publications from the HTAP program.
36281	41	1			D.1.4. is too long-winded for the Kigali Ammendment, it should be at most 2 sentences. Further, the comment on energy efficiency efficiency for AC is happening across the spectrum of all industries: this is not SPM materail, it is NOT attributable to Kigali - it is misleading. I hope that the 0.2-0.4C quoted here does NOT include changes in AC efficiency, if so, it cannot be used as it is not how other gases have been evaluated. [Michael PRATHER, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
41265	41	3	41	3	"from" should be "of"? [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
41267	41	3	41	5	Is this reduction implicitly already in the low SSPs? Is there a danger of double counting this reduction if the SSPs already assumed that HFC emissions would NOT continue unregulated? I have been, and remain, concerned that the benchmark that the analyses of the Kigali agreement often use (unregulated emissions) was an unrealistic one, as many national and transnational regulations were already in place prior to Kigali. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28055	41	4	41	4	Two ranges mentioned in chapter 6: 0.2-0.4 mentioned in paragraph 6.6.4 Compensating effects and linkages in SLCFs under different mitigation scenarios (page 79, line 20) and 0.3–0.5°C mentioned in paragraph 6.5.3.3 Kigali Amendment (page 66, line 55) Please assure the consistency. [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
35283	41	4			Your 2100 Kigali "savings" are economically indefensible. It assumes that--sans Kigali--that the entire developed world will adopt air conditioning driven by a single refrigerant class. Mechanical technologies are never that stable. I would delete all references to Kigali here and elsewhere because the assumptions behind it are untenable. [patrick Michaels, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
25973	41	5	41	8	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed for statements of facts or when quantified uncertainties are provided.
28057	41	5	41	8	The sentence is not accurate as the results mentioned in this paragraph only come from the Kigali amendment. The climate benefits would be higher if energy efficiency is improved in parallel. See paragraph 6.5.3.3 Kigali amendment (page 66, line 17), it is written "Furthermore the energy efficiency improvements of cooling equipment alongside the transition to low global warming potential alternative refrigerants for refrigeration and air-conditioner equipment could potentially increase the climate benefits from the HFC phasedown under the Kigali Amendment (Shah et al., 2015; Höglund-Isaksson et al., 2017; Purohit and Höglund-Isaksson, 2017; WMO, 2018). One sentence could be added highlighting that the climate benefits from the HFC phasedown could be further increased with energy efficiency improvements. [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
50417	41	7	41	end	The SPM material on CDRs seems to lack a bit of context as currently presented. At the least, I think it would be helpful to state here to what extent deployment of CDRs is assumed in the various future emission scenarios used for the CMIP-6 projection sections and/or key findings from the SR1.5 (or present report) around the extent to which deployment of CDRs will (likely, etc) be needed to meet Paris Agreement warming goals (1.5 or 2.0). The following text from the executive summary of chapter 4 would help clarify this - "Emission pathways that limit globally averaged warming to 1.5°C or 2°C typically assume the use of carbon dioxide removal (CDR) approaches in combination with emissions reductions. However, under high-emission scenarios, model-based assessments suggest that CDR approaches currently considered viable have limited potential in mitigating warming (medium confidence)." [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - As the level of deployment of CDR in scenarios is not part of the assessment of WG1, the decision was made not to highlight this in the SPM. The SYR can provide an integration of evidence in this regard.
28059	41	8	41	8	Isn't it 6.6.4 instead of 6.6.3? [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
65639	41	11	41	24	This figure could be considered to be misleading. In most cases, anthropogenic CO2 emissions are co-produced with other emissions such as CH4, N2O and aerosols so is it feasible to consider a world with only CO2 emissions? [Kushla Munro, Australia]	Noted - the figure shows 5 scenarios with very varying assumptions for non-CO2 emissions, some of which show very deep CH4 emissions in the near term. Nevertheless, all five show a very clear near-linear relationship. The figure is therefore considered an accurate reflection of the overall near-linear relationship between cumulative CO2 emissions and global warming in the past and the future
65641	41	11	41	24	This figure seems misleading. The projection appears contingent on some special assumptions about the future of methane emissions even though the caption indicates that one set of curves relate to CO2 emissions only. If methane emissions were stopped immediately, as indicated by the caption, then, in the short term, presumably global temperatures would fall significantly given the data reported earlier in the SPM. [Kushla Munro, Australia]	Noted - the figure shows 5 scenarios with very varying assumptions for non-CO2 emissions, some of which show very deep CH4 emissions in the near term. Nevertheless, all five show a very clear near-linear relationship. The figure is therefore considered an accurate reflection of the overall near-linear relationship between cumulative CO2 emissions and global warming in the past and the future
65643	41	11	41	24	This figure seems misleading. The projection appears contingent on some special assumptions about the future of aerosol emissions even though the caption indicates that one set of curves relate to CO2 emissions only. If aerosol emissions were stopped immediately, as indicated by the caption, then, in the short term, presumably global temperatures would rise significantly given the data reported earlier in the SPM. [Kushla Munro, Australia]	Noted - the figure shows 5 scenarios with very varying assumptions for non-CO2 emissions, some of which show very deep CH4 emissions in the near term. Nevertheless, all five show a very clear near-linear relationship. The figure is therefore considered an accurate reflection of the overall near-linear relationship between cumulative CO2 emissions and global warming in the past and the future
28133	41	11			Regarding SPM Figure.10: - We recommend to show also for the year 2100 the amount of cumulative CO2 emissions and assessed median GSAT warming for each of the respective scenarios, even if the linearity would a bit less obvious. - The term "illustrative uncertainty range" for the historical period should be explained in the caption. - The numbers on the y-axis should have the '+' sign in front of them. [Eric Brun, France]	Rejected - The choice was made to show the relationship for projections until 2050 because this: (1) ensures that cumulative CO2 emissions remain within the assessed domain for near-linearity available in the underlying report, (2) all scenarios continue to show increasing cumulative CO2 emissions (the domain of assessed applicability of TCRE), and (3) the importance of emissions pathways over the next 3 decades is communicated.
112613	41	13	41	22	Re-express to use a global temperature metric consistent with other figures. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112617	41	13	41	22	As we found following AR5, this presentation, which implies a constant, scenario-independent "effective TCRE", is misleading for ambitious mitigation scenarios (see Rogelj, J., Forster, P. M., Kriegler, E., Smith, C. J. & Séférian, R. Estimating and tracking the remaining carbon budget for stringent climate targets. Nature 571, 335–342 (2019) and Mengis, N., Matthews, H.D. Non-CO2 forcing changes will likely decrease the remaining carbon budget for 1.5 °C. npj Clim Atmos Sci 3, 19 (2020), both of which argue strongly that the concept of an effective TCRE is fundamentally flawed). It would be much more consistent with the mandate of Working Group 1 to plot future warming against $E + \Delta F/\alpha$, where E is cumulative CO2 emissions and ΔF the change in non-CO2 radiative forcing (you could use CO2-fe emissions if you prefer, but $E + \Delta F/\alpha$ is easier to explain, α being the forcing per tonne of CO2 emitted, or AGWP_H/H). This relationship is determined by the physical climate system: the contribution of non-CO2 climate forcing in ambitious mitigation scenarios depends on policy choices as well as scientific uncertainty. Since the plot is already expressed relative to the 2010s, ΔF and α can be defined accordingly, making it all very simple, resolving the difference between the grey and coloured bands, making the role of the TCRE transparent, and even bringing in AGWP, which governments have been using since the 1st Assessment. You will have to contend with people arguing that plotting against CO2 is more "policy relevant", but actually the reverse is true in the context of a long-term temperature goal: $E + \Delta F/\alpha$ determines future warming. E does not. [Myles Allen, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - The SPM aims to represent evidence assessed in the underlying report. Suggesting a method without a reference is insufficient evidence at this stage.
36283	41	13			As in AR5, this figure SPM.10 is a fitting finale. It is hard to see a central line for the gray CO2-only case, the gray band is there, but a middle line should be there to compare with the SSPs including all emissions. [Michael PRATHER, United States of America]	Taken into account - visibility of elements in the figure is further improved.
130263	41	19	41	20	Delete the sentence starting with "The cancellation of warming by SRM would likely be incomplete..." This sentence is repeating (almost verbatim) what was stated in the red box for D.3 located 6 lines above this sentence. [Trigg Talley, United States of America]	Not applicable. The part on SRM has been removed from the revised SPM, to keep the SPM short and focus on what matters most to policy-makers.
69433	41	20	41	21	Since the AR6/WG1 report will be published in 2021, the discussion on difference in CO2 emission in 2020 among different scenarios would seem irrelevant. It might be useful to reconsider the formulation. [Kaoru Magosaki, Japan]	Taken into account. This discussion is removed from the caption of figure SPM.10 and the circles and crosses no longer appear on the figure.
104265	41	27	41	35	Comments on D2 headline statement: * the statement should give a brief definition of CDR technologies (make clear what is and is not included) and clarify in the main statements of the section. * the statement should also point out that the technologies mentioned have yet to be demonstrated and deployed at scale. Therefore statements such as "Carbon dioxide removal (CDR) methods can sequester CO2 from the atmosphere" are only true in a theoretical sense. * the risks and consequences of different technologies (as detailed in D2.2) should also be reflected in the headline statement. [Philippe Tulkens, Belgium]	Rejected - Due to space constraints, this additional detail was not added, and the headline statement was streamlined with CDR being covered in sub-bullets rather than in the headline. The socioeconomic feasibility or technological readiness of these options is not part of the WG1 assessment, and is something that can be integrated at the level of the SYR.
97421	41	27	41	35	Please mention the scale dependence of the potentials and risks. [Nicole Wilke, Germany]	Accepted - the statement now mentioned the dependence on the large-scale deployment of these measures.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
117249	41	27	42	7	As a non CDR expert I didn't learn much from this section. To vague. I would at least point to a list of CDR methods as a footnote. [Maisa Rojas, Chile]	Rejected - Given the limited space available in the SPM this section was kept at the more general level of CDR.
104267	41	27	42	7	<p>This section should include more specific considerations for the CDR methods implied (ranging from nature-based solutions to technologies such as BECCS & DACCS as well as ocean-based approaches) as they are likely to differ substantially in factors such as their likelihood of deployment, efficacy and side effects. The generic language used can lead to an apparent mismatch among uncertainty language and confidence statements.</p> <p>Suggestion: shorten D2.1 (general explanation of CDR / carbon-cycle interaction) and add a new section D2.2 outlining different methods and technologies.</p> <p>If possible, the section should comment on the IPBES finding 'Land-based climate mitigation activities can be effective and support conservation goals. However, the large-scale deployment of bioenergy plantations and afforestation of non-forest ecosystems can come with negative side effects for biodiversity and ecosystem function'. (IPBES GA D8). [Philippe Tulkens, Belgium]</p>	Rejected - Due to space constraints, this additional detail was not added, and the headline statement was streamlined with CDR being covered in sub-bullets rather than in the headline. The aspects requested to be highlighted is not part of the core WG1 assessment, but will be covered in WG2 and WG3, and can be integrated at the level of the SYR.
78981	41	27	42	7	A key information here would be the potential amount of CDR that can take place given different constraints and risks. We suggest to indicate that some of these limits and risks are out of scope of the WGI report but could be found in the SRCCL and WGIII contributions to AR6. [Martine Vanderstraeten, Belgium]	Rejected - As the level of deployment of CDR in scenarios is not part of the assessment of WG1, the decision was made not to highlight this in the SPM. The SYR can provide an integration of evidence in this regard.
87301	41	27	42	33	There are a lot of aspects on CDR and SRM not only geophysical. Perhaps it is better to synthesize all information in the SYR. Remove D2 and D3 could also help to shorten the WGI SPM [Marcel Berk, Netherlands]	Taken into account. D3 has been removed from the SPM. D2 has been kept due to its policy relevance. WGI-related material on CDR is policy relevant as CDR features in SSP1-1.9 and SSP1-2.6 scenarios. This topic can be further built upon in the WGII and WGIII reports.
42045	41	27	42	33	Sections D2 and D3 deal with CDR and SRM methods. This is a very broad topic, which is why the authors should carefully evaluate does the text reflect the full scale of alternative methods, impacts, side-effects, uncertainties related to these? For example, cf. Chapter 4, P78, L2-3: "However, it should be cautioned that none of the CDR proposals has been proved to work in reality, especially at large scale, and their overall lifecycle emission balance raises questions about their carbon negativity". [Juhani Damski, Finland]	Taken into account. For sake of brevity, the point on SRM has been removed. The point on CDR has been clarified in D1.4-D1.6
111247	41	27	42	33	Two sub-sections D.2 on CDR and D.3 on SRM can be merged as artificial geophysical mitigation means [Volodymyr Osadchy, Ukraine]	Not applicable. Section on SRM removed from the revised to shorten the SPM.
130461	41	27	42	33	Biodiversity should not be include under "societal issues". [Panmao Zhai, China]	Taken into account - mention of "societal issues" was deleted.
28061	41	27			It is very difficult to retain key messages from Sub-section D2. There are no quantitative findings expressed in the messages, which limits their impact and their interest for policy-makers. Some quantitative findings of 4.6 and Figure 4.40 might be reflected in D2 headline and D2.1, for example those related to the time lags for GSAT, SLR and Arctic sea-ice. [Eric Brun, France]	Accepted - This headline statement has been removed and the findings integrated in the new HS.13 sub bullets
78287	41	29	29	50	It would be useful to include the scale of carbon dioxide removal (CDR) from natural sinks. This has already been covered in Section B, but suggest to expand further here to cover the rate of change in CDR capacity from natural sinks and trends over time. [Leonie Lee, Singapore]	Rejected - outside of scope of this SPM section.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69435	41	29	41	29	It would be better to add some explanations of the CDR in footnote. For instance, the 'CDR refers to anthropogenic activities that remove CO2 from the atmosphere and durably store it in geological, terrestrial or ocean reservoirs, or in products (SR1.5, Glossary).' [Kaoru Magosaki, Japan]	Rejected - definition provided in glossary and not repeated in SPM due to space constraints.
97423	41	29	41	29	The first part of the sentence seems like a trivial statement that is fulfilled by definition of a CDR method as given in 4-75-26. It should be omitted or better expressed to make clear what is actually meant: Is "sequestered from the atmosphere" something different than "removed durably" from the atmosphere? We suppose what is meant is that taking out CO2 (via a CDR method) from the atmosphere is also leading to a global reduction in CO2 concentration (or total amount) after consideration of earth system feedbacks. Why is this not assigned "very high confidence"? [Nicole Wilke, Germany]	Noted. Sentence was deleted.
79353	41	29	41	29	Carbon dioxide removal (CDR) is not common in language around the problem of enhanced atmospheric CO2 and often terms like CCS and CCUS are used to indicate specific links to both the sequestration and subsequent storage. I expect the adoption of CDR varies among local and national governments and policymakers. For ease of access to information, I suggest adding CDR to Box SPM.1 (Page SPM-3, Line 38). [Jaime Toney, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - CDR defined in glossary.
34553	41	29	41	29	It would be helpful to include an example or two for the reader -- e.g., "Carbon Dioxide Reduction (CDR) methods such afforestation and ... " [Russell Vose, United States of America]	Rejected - examples omitted due to space constraints.
87355	41	29	41	30	Make clear this related to biological sequestration only. [Marcel Berk, Netherlands]	No longer applicable - sentence was deleted.
87009	41	29	41	30	While the desired outcomes from some CDR options will be weakened by earth system feedbacks (i.e. on the carbon cycle), they also depend upon (and may be counteracted by) more immediate biogeophysical factors that may vary from place to place. Please consider to describe such factors. [Oyvind Christophersen, Norway]	Taken into account - unintended climate effects of CDR mentioned in HS.13.4
90219	41	29	41	34	The two first sentences of this headline-statement seem policy-relevant to as: "Carbon dioxide removal (CDR) methods can sequester CO2 from the atmosphere (high confidence), but the sequestration can be weakened by evolving Earth system feedbacks (medium confidence). Wide-ranging potential side-effects of CDR methods have been identified and can either amplify or reduce local climate change and affect the achievement of other societal goals (high confidence)." [Georges Gehl, Luxembourg]	Noted. Unclear which action is suggested.
78983	41	29	41	34	The statement is very conceptual. Numbers on the potential scale of CDR are missing. Risks or side effects seems to be largely out of scope of this report as well as method dependent, but they are mentioned here in a way that seems vague. Please try to be more concrete and/or explain the limits of the assesement by WGI, refering to SRCCL and others contributions to AR6 as needed. [Martine Vanderstraeten, Belgium]	Taken into account - handshake with WGIII explained in footnote

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9635	41	29	41	34	The statement that "sequestration can be weakened" is too much of a shortcut. Sequestration is not weakened per se. The rate of sequestration by nature-based solutions may become slower with climate change. The effects of sequestration may be weakened by feedbacks. But sequestration per se is not weakened. Paragraph D.2.1 is well written in that respect. And most importantly this is not specific to negative emissions. Feedbacks behave the same for positive and negative emissions for given CO2 concentration and warming level. [Olivier Boucher, France]	Noted. Sentence was deleted.
87007	41	29	41	34	This highlighted conclusion is of uttermost importance, and could, with benefits, include more specific information. Firstly, we suggest that the first half of the first sentence is replaced, since it is only explaining a rather clear abbreviation with more complicated words. We think this half-sentence could be replaced by a new half-sentence picked up from para D2.1. Therefore, please consider if a full first sentence could read e.g. "Land- and ocean-based Carbon Dioxide Removal (CDR) methods have the potential to remove CO2 from the atmosphere (high confidence), but such removal can be weakened by evolving Earth system feedbacks such as xxx and yyy (medium confidence)". We believe that specificity regarding what is ment with Earth system feedbacks here in this context is important. We also think you can be more specific when it comes to which potential side-effects (synergies and trade-offs) of CDR that have been identified. Please also consider to explicitly mention that such methods are in fact needed to achieve the net-zero or net-negative CO2 emissions mentioned in the previous highlighted conclusion, D.1. Please also consider to describe the similar situation, but then under the assumption that CO2 concentration has stabilized and that it is net-zero emissions due to a balance between emissions and removals, as in the Paris Agreements long term global goal. In such a case we assume that the extra amount mentioned in the sentence is not relevant? This is also connected to the statement from SR1.5 which said that historical emissions up until today alone are unlikely to cause global warming of 1.5°C (see SR1.5 Section A.2). Please consider to be more nuanced and you might need to distinguish between a situation when net zero is reached, and a situation where CDR is used to compensate for earlier emissions (e.g. in overshoot scenarios). And be attentive to what is described in the highlighted conclusion, associated SPM bullets and in the Technical summary [Oyvind Christophersen, Norway]	Noted. Summary statement was deleted.
50411	41	29	41	34	At some point in D2 it would be helpful to include an explanation of why CDR is required (i.e. to balance / outweigh residual emissions, and thus reach net zero / negative). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this is now mentioned in HS.13.4
39949	41	29	41	49	As CDR technology does not currently exist at scale, could the word potential be added when describing CDR? [TSU WGI, France]	Noted - conditional statements are used.
77095	41	29	41	54	CRD is evolving rapidly and statements should avoid mixing sink management with other approaches and particularly SRM. [Emer Griffin, Ireland]	Comment unclear - there is no reference to SRM but in any case the part on SRM has been removed from the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130265	41	29	42	7	D.2 is based on a lot of information -- summarized in Chapter 5, pages 88-99 and 165-66 -- that is highly relevant to policymakers; however, the language throughout D.2 is quite general and does not capture important elements of the Chapter 5 findings. It is essential that policymakers can see at a glance the main CDR strategies and understand the strengths, drawbacks, and risks of each. In particular, policymakers should be informed of the potential for significant CDR accomplished through enhanced plant cover and photosynthesis in agricultural lands and restored natural areas. Organic agriculture, agroforestry, advanced grazing management, and other soil health-based production systems can contribute significant CDR (potentially rendering the world's agriculture carbon-neutral) while enhancing food system resilience to climate change impacts. See additional comments and literature references on this topic in the line-by-line comments on Chapter 5. Consider amending the pink box summary and adding two paragraphs to Section D.2, as follows (new language in CAPITALS): Suggested modifications to pink box summary: ""Carbon dioxide removal (CDR) methods can sequester CO2 from the atmosphere (high confidence), but the sequestration can be weakened by evolving Earth system feedbacks (medium confidence). Wide-ranging potential side-effects of CDR methods have been identified and can either amplify or reduce local climate change and affect the achievement of other societal goals (high confidence). These effects are highly project-, region-, and context-specific affecting the level of confidence with which they can be assessed. OVERALL, CDR STRATEGIES BASED ON LAND PLANT PHOTOSYNTHESIS AND SOIL HEALTH MANAGEMENT APPEAR SAFEST AND MOST TECHNICALLY PRACTICAL."" New paragraphs: ""D.2.3. CDR STRATEGIES BASED ON LAND PLANT PHOTOSYNTHESIS AND SOIL BIOLOGICAL PROCESSES APPEAR SAFEST AND MOST PRACTICAL. THESE STRATEGIES INCLUDE AGROFORESTRY, ADVANCED GRAZING MANAGEMENT, ORGANIC AGRICULTURE, CONSERVATION AGRICULTURE, PERMACULTURE,	Rejected - proposed details not assessed in report.
107505	41	29	42	7	There is much theory, but no observations evidence that net CO2 removal would significantly lower temperature levels. Discussion for policymaker should note this risk. [Hunter Cutting, United States of America]	Noted. Based on theoretical understanding and modelling there is high confidence that global warming would be reversed if emissions become net negative.
17535	41	29			It would help if 'CDR methods is explained. Is a handshake with WGIII and their use in mitigation needed here? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - handshake with WGIII explained in footnote
36285	41	29			Good headline, but some material can be put below to highlight the big issue: 1st sentence and maybe 3rd. [Michael PRATHER, United States of America]	Noted. Summary statement was deleted.
28063	41	30	41	30	The statement that "sequestration can be weakened" is too much of a shortcut. Sequestration is not weakened per se. The rate of sequestration by nature-based solutions may become slower with climate change. The effects of sequestration may be weakened by feedbacks. But sequestration per se is not weakened. Paragraph D.2.1 is well written in that respect. And most importantly this is not specific to negative emissions. Feedbacks behave the same for positive and negative emissions for given CO2 concentration and warming level. [Eric Brun, France]	Noted - sequestration replaced with sequestration potential.
28065	41	30	41	30	Could you clarify the notion of "Earth system feedback"? [Eric Brun, France]	Taken into account - term no longer used.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131835	41	30	41	30	Technical term "Earth system feedbacks", consider using another word. Looked it up in Glossary, it shows the reports, where the term appears, but no explanation [Hans Poertner and WGII TSU, Germany]	Taken into account - term no longer used.
90791	41	31	41	31	Write: "Wide-ranging potential side-effects and risks of CDR methods ..." [José Romero, Switzerland]	Noted. Risk terminology not used in report in CDR context.
9637	41	31	41	32	This is too much of a blanket statement. Which CDR options are considered here? Many would say that mitigation affects the achievement of other societal goals. The last sentence qualifies the statement on lines 31-32 but this is not sufficient. Again I find the text in D.2.2 to be more balanced than in the coloured paragraph. [Olivier Boucher, France]	Taken into account. Summary paragraph was deleted.
87357	41	31	41	34	D2 is formulated in too general language that obscures the messages about different options for CDR. Need to be clearer formulated by referring to specific CDR options. [Marcel Berk, Netherlands]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6
17537	41	31			... side effects of CDR methods have been identified - is this 'since AR5'? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Sentence has been rephrased.
29431	41	32	41	32	The term 'achievement of other societal goals' needs more explanation. [Joachim Fallmann, Germany]	Taken into account - this term does not appear anymore in the final SPM text.
25975	41	32	41	34	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed for statements of facts or when quantified uncertainties are provided.
8189	41	37	41	37	Observations+modelling=earth system understanding. Rephrase [Frank Dentener, Italy]	Noted. Sentence was deleted.
53521	41	37	41	38	Will the different proposed CDR techniques have additive effects or will this net effect be lower than the sum of the individual contributions? [Hervé Douville, France]	Noted. Additivity not addressed in report.
131837	41	37	41	42	The sentence on the redistribution between carbon pools is not clear - can you simply for the reader? [Hans Poertner and WGII TSU, Germany]	Noted. Sentence was deleted.
104269	41	37	41	50	Where applicable, the effect of different CDR techniques on acidity of the oceans should be mentioned. It is unclear whether the reversal of ocean acidification would also apply to ocean-based CDR, which would sequester CO ₂ in the ocean (mentioned in the first sentence of the paragraph and of the headline statement of D2). [Philippe Tulkens, Belgium]	Noted. Paragraph no longer addresses ocean acidification.
104271	41	37	41	50	It is unclear whether the reference to "land- and ocean-based" methods is limited to the first sentence (confidence about potential), or to the whole paragraph. I.e., to what extent the considerations in the text apply to methods like free air capture. [Philippe Tulkens, Belgium]	Noted. Reference to land and ocean CDR methods was deleted.
97425	41	37	41	50	Here some short examples of major land and ocean sinks could increase accessibility of the SPM, as readers would not have to consult chapter 5 to understand how land and ocean function as sinks, which is not explained in the SPM. [Nicole Wilke, Germany]	Noted. Proposed detail beyond scope of SPM.
111797	41	37	41	50	It would be better to integrate some examples for CDR methods [Oliver Geden, Germany]	Rejected - unfortunately, due to space constraints, specific examples cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50413	41	37	41	50	This para is unnecessarily detailed for the SPM. It could be shortened, and important points about uncertainties over carbon negativity (from ch.4 p8 lines 42-44) and "extra" amounts of CDR being needed (from ch.5 p9 lines 16-17; why is this statement only "low confidence"?) brought in here, thus: Land- and ocean-based CDR methods have the potential to remove CO2 from the atmosphere (high confidence), but uncertainties over their overall lifecycle emissions balance raise questions about their carbon negativity. Feedbacks mean land and ocean sinks would release some CO2 back into the atmosphere resulting in less CO2 effectively being removed (medium confidence) so an extra amount of CDR is required to offset a positive emission of a given magnitude (low confidence). Reversing the increase in atmospheric CO2 concentration by CDR will reverse ocean acidification at the sea surface but will not result in rapid amelioration of ocean acidification in the deeper ocean (medium confidence). {Figure 5.33, Figure 5.34, 5.3.3, 5.6.2, TS Figure.36} [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - paragraph was rewritten.
8191	41	37	41	50	It would be useful to discuss which forms of CO2 removal are discussed here-probably not CSS. [Frank Dentener, Italy]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6
131839	41	37	41	54	can you give examples of earth system feedbacks? [Hans Poertner and WGII TSU, Germany]	Noted. Reference to earth system feedbacks was deleted.
87011	41	37	42	7	There seems to be some overlap when describing how the potential and efficiency of CDR and Earth system feedbacks are interacting in D2.1 and D2.2. Please consider to focus D2.1 on potential and efficiency and D2.2 on positive and negative side-effects. [Oyvind Christophersen, Norway]	Taken into account - bullets were rewritten.
42287	41	40	41	41	D2.1: L40-41 delete "...resulting in less CO2 effectively being removed". Effectiveness is described in the following sentence. [Tina Christensen, Denmark]	Noted. Sentence was deleted.
97427	41	41	41	47	Please explain why the cooling effectiveness of CDR would be dependent on the emission rate with higher CO2-concentrations and what compensating effects are effective. [Nicole Wilke, Germany]	Noted. Sentence was deleted. Details are provided in Ch 5.
104273	41	41	42	44	Would the statement on the effectiveness being independent from the magnitude of deployment apply equally to all CDR methods? E.g., does it take into account the interaction of land-based CDR with natural sinks, the hydrological cycle or competition with other demands on productive land? [Philippe Tulkens, Belgium]	Noted. Sentence was deleted.
28067	41	42	41	42	The definition of "CO2 per CO2 unit sequestered" is important. It refers to feedbacks which deserve a short mention in the SPM. [Eric Brun, France]	Noted. Sentence was deleted.
130267	41	42	41	42	It might be more appropriate for the definition of CDR to be introduced earlier in this paragraph. [Trigg Talley, United States of America]	Noted. CDR defined in glossary.
111693	41	42	41	44	It would be very helpful to give a range for this quantity, even if it's wide [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Effectiveness no longer mentioned in SPM.
23421	41	42	41	44	So, the effectiveness is independent of the removal rate but dependent on the CO2 concentration? Just one example of sentence that can be simplified/clearer. [Anna Amelia Sörensson, Argentina]	Noted. Sentence was deleted. Details are provided in Ch 5.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54705	41	42	41	47	These two sentences seem to contradict one another. Suggest sentence 2 is more important to convey to policy-makers (that CDR results in an approx. constant cooling effect whether removed in a high or low emissions world. The first sentence could be deleted (which says CDR is more effective at high atmospheric CO2 concentrations). A more important message related to high background CO2 worlds and CDR would be from Ch. 4 ExSumm lines 39-41 that the cooling contribution from CDR is limited in such high CO2/high emission worlds. [Nancy Hamzawi, Canada]	Noted. Paragraph was rewritten
44889	41	43	41	47	The reason for the discussion here is not clear as the bottom line would seem to be that there is not much of difference in effect, under different emissions. Also, "low" and "high" emission worlds is vague and could be reworded as appropriate. [Markku Rummukainen, Sweden]	Noted. Sentence was deleted.
36287	41	46			Is this true given the log relationship between CO2 and ERF? [Michael PRATHER, United States of America]	Noted. Sentence was deleted.
28069	41	47	41	49	The term "rapid" is a bit vague. - Will the ocean acidification at the sea surface be "rapid"? - At what time scale will the situation of the deeper ocean ameliorate ? Will it? Specify for both cases what timescale we are talking about [Eric Brun, France]	Noted. Reference to ocean acidification was deleted.
131841	41	47	41	50	The point on ocean acidification could be a separate bullet as it introduces a new concept - this gives space for additional information [Hans Poertner and WGII TSU, Germany]	Noted. Reference to ocean acidification was deleted.
50415	41	47	41	50	In Ch.5 p.50 rows 25-32 we find (slightly unclear) text about the impossibility of reversing ocean acidification on human timescales. This should be stated clearly here in the context of CDR. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Reference to ocean acidification was deleted.
41029	41	48	41	48	The word "reverse" makes it sound like changes in the ocean (e.g., coral bleaching could be reversed) with any change in pH. Maybe the word reduce? (even if pH would go up) [TSU WGI, France]	Noted. Sentence was deleted.
130269	41	48	41	48	Will CDR reverse ocean acidification because the oceans will "recover" from taking up the extra CO2? The statement sounds like CDR will "cure" the oceans of acidification in the sea surface. [Trigg Talley, United States of America]	Noted. Sentence was deleted.
111695	41	48	41	49	Presumably this only refers to land-based or under-seafloor CDR? [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Sentence was deleted.
77097	41	52	42	1	What are the specific measures that are being referenced? [Emer Griffin, Ireland]	Noted. statement does not refer to specific CDR measures
44917	41	52	42	4	It would be useful if there were additional clarity of such side-effects. It is now stated that there are positive and negative ones at the beginning of D2.2, but the reminder of the bullet talks just about "changes" without explaining which these may be and which would be negative and which positive. [Markku Rummukainen, Sweden]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6
104275	41	52	42	7	Paragraph D.2.2 should be improved by providing distinguished information between different CDR methods, incl. land vs ocean-based. There are significant differences in terms of potential, feasibility, sustainability, trade-offs and synergies among methods. [Philippe Tulkens, Belgium]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6
97429	41	52			Please provide an example of a positive side effect of CDR, we cannot think of one that would outweigh the negative ones. [Nicole Wilke, Germany]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6

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54707	41	53	42	1	This paragraph is focused on side effects from CDR therefore this text, that repeats text in the paragraph above about feedbacks leading to declining effectiveness of CDR, could be deleted. [Nancy Hamzawi, Canada]	Taken into account - paragraphs were consolidated and repetitions avoided.
116127	41		41		D1.4 is a point of coordination across WG. WGI shows the importance of heat island effects, increases in heat extremes and heat stress, which would increase the demand for cooling. How is this integrated in this evaluation? How is this evaluation linked to SSPs (reduction in global warming compared to what and in which scenario)? [Valerie Masson-Delmotte, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
28071	42	1	42	2	It's very good to have these parenthesis. [Eric Brun, France]	Noted.
87469	42	1	42	3	The societal impacts of CDR may be inequitable. Since equity is a term of art in the Paris Agreement, perhaps it would be appropriate to say 'biophysical ... or societal, related to equity concerns such as water availability, food security...' [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - sentence has been rewritten.
86603	42	1			Not sure what you mean by biogeochemical side-effects (changes in non-co2 emissions). [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Sentence has been rewritten.
23423	42	2	42	2	What does this high confidence refer to? Only the biophysical side-effects? [Anna Amelia Sörensson, Argentina]	Noted. Sentence has been rewritten.
23425	42	3	42	3	Shouldn't this be just a statement of fact? You are stating that a list of side-effects have been identified. [Anna Amelia Sörensson, Argentina]	Noted. Sentence has been rewritten.
28073	42	4	42	5	Please add a specific paragraph on CDR, and especially the risks linked to it. Also, please delete the sentences without any direction (positive or negative). [Eric Brun, France]	Noted. Sentence has been deleted.
36289	42	4			Good point, but better here than repeated in headline! [Michael PRATHER, United States of America]	Noted. Headline statement was deleted.
97431	42	5	42	6	This might be true for biogeochemical and biophysical effects, but less so for societal. Please clarify. [Nicole Wilke, Germany]	Noted. Sentence was deleted.
77099	42	5	42	7	The last sentence seems odd, perhaps it can be applied to wider approaches to addressing climate change addressed in the next section. [Emer Griffin, Ireland]	Noted. Sentence was deleted.
111697	42	5	42	7	It would be useful to give some indication of the currently-deemed-possible scales of CDR, e.g. is SSP1-1.9 the best that can be done? I realise this is WGIII territory but it's important for WGI to quantify the range of potential climate control that WGI is assessing. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Rejected - beyond scope of WGI assessment.
86493	42	5	42	7	This is a vague statement, please quantify 'scales currently deemed possible'. And what are the 'effects of terminating CDR'? [Ala Taimar, Estonia]	Noted. Sentence was deleted.
50425	42	5	42	7	The direction and magnitude of the side-effects of individual CDR methods vary, are often project- and region-specific and are associated with widely varying levels of confidence' - suggest it would be helpful to point out here that this may be in part expected as the as current deployment scale is small. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. Sentence was deleted.
8193	42	6	42	7	The intention of the sentence is unclear. One of the problems of carbon sequestration on agricultural land, is that the management practice needs to be kept in place for long-times, otherwise the carbon gains will be re-released into the atmosphere. It looks like the sentence here, is contradictory to this finding. [Frank Dentener, Italy]	Noted. Sentence was deleted.

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7721	42	6	42	7	Even more relevant than the information "The effects of terminating CDR are expected to be small for the deployment of CDR that is applied at scales currently deemed possible" would be information on the "scale of CDR that is currently deemed possible" and the barriers to enhance that scale. It is strongly recommended to include such information in the SPM. [Klaus Radunsky, Austria]	Rejected - barriers to deployment not assessed in WGI report.
104277	42	6	42	7	The intention of the sentence is unclear. One of the problems of carbon sequestration on agricultural land, is that the management practice needs to be kept in place for long-times, otherwise the carbon gains will be re-released into the atmosphere. It looks like the sentence here, is contradictory to this finding. [Philippe Tulkens, Belgium]	Noted. Sentence was deleted.
78985	42	6	42	7	This last sentence does not appear useful. CDR termination is indeed not a concern wrt adverse geophysical effects, but it is rather straightforward. We suggest deleting as a contribution to reduce the lenght of the SPM. [Martine Vanderstraeten, Belgium]	Taken into account - sentence was deleted.
28075	42	6	42	7	This sentence is quite difficult to interpret. [Eric Brun, France]	Taken into account - sentence was deleted.
9553	42	7	42	7	Include cross reference to section 8.6.3 on water cycle [Joelle Joelle Gergis, Australia]	Not applicable. Section removed from revised SPM.
97433	42	7			Please quantify the „scales currently deemed possible“. And does „possible“ include socio-economic, cultural, ethical and political aspects? [Nicole Wilke, Germany]	Noted. Sentence was deleted.
8201	42	10	42	10	As interannual variability is also important for ozone and aerosol, detection will need at least a couple of years, in particular because emissions will not change abruptly. [Frank Dentener, Italy]	Noted but not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
69973	42	10	42	10	I remember that SRM is mentioned as a abbreviation of "Solar Radiation Management" in AR5. Is there special reason to use "Modification" instead of "Management"? [Young-Hwa BYUN, Republic of Korea]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
90221	42	10	42	15	This headline statement is policy-relevant but needs to be complemented by the risk associated with SRM technologies and identified in the underlying report (see our comment on the whole section). [Georges Gehl, Luxembourg]	Not applicable. Bullet point has been removed from the revised SPM due to shortening constraints. SRM is now covered in the Technical Summary only where space allows to cover the topic in further detail.
7723	42	10	42	33	These paragraphs are helpful but should be further developed. It is helpful to include that "a gradual phase-out of SRM combined with mitigation and deploying global scale net CDR would likely avoid these large rates of warming". However, what is missing is the linkage to the "scale of CDR deemed possible". It is highly recommended to address this issue explicitly. [Klaus Radunsky, Austria]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.

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18735	42	10	42	33	The SRM assessment does not accurately reflect the developments since AR5. The current content is what was already said in AR5. The main new development is discussed in the Technical Summary as below and this may be discussed in SPM too in addition to what is already discussed: "Since the AR5, more modelling work has been conducted on SRM with more sophisticated treatment of aerosol-based SRM approaches, such as stratospheric aerosol injections, marine cloud brightening and cirrus cloud thinning, but the uncertainties in cloud-aerosol-radiation interactions are still large (high confidence). Modelling studies suggest that it is possible to meet multiple large-scale temperature and precipitation stabilization goals simultaneously by tailoring the deployment strategy of SRM options (medium confidence) but with large residual or overcompensating regional and seasonal climate changes. The effect of SRM on global temperature and precipitation has been found to be detectable after one to two decades which is similar to the timescale for the detection of mitigation effects." [Govindasamy Bala, India]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
42289	42	10	42	33	D3. Add examples of SRM? Could be a reference to glossary? [Tina Christensen, Denmark]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
104279	42	10	42	33	Subsection D.3 should provide information about the weather consequences of solar radiation modification, and the lack of predicatbility and control of this activity. [Philippe Tulkens, Belgium]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
90223	42	10	42	33	The way SRM is presented in the SPM seems to miss the balance that is found in the underlying report. In particular, we miss a reference to key side effects of the various SRM techniques in the SPM (e.g. impact on ozone whole recovery, decrease in crop yields and impacts on biodiversity). Also the fact that some SRM techniques are very likely to reduce global mean precipitation relative to future CO2 emissions scenarios (TS-88:29-31) and that the assessment is based primarily on idealized climate model simulations (TS-88:4-5), which makes it very theoretical, are not mentioned. [Georges Gehl, Luxembourg]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
44919	42	10	42	33	The risks of negative side-effects would be useful to bring better to the fore here, both in the headline statement and the bullets. In the present draft, negative side effects are hardly mentioned at all. Instead, carbon sink increases are mentioned, which can be comprehended as a positive effect. Some order of magnitude of such an effect (set against the magnitude of SRM) would also be useful for deeper understanding of the significance. [Markku Rummukainen , Sweden]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
78987	42	10	42	33	D3 is an important section for de SPM but it is currently weak. Information on associated risks are missing. There is a need for more precision as well as clarifications regarding the limits of the evaluation of risks within the WGI contribution to AR6, noting that more information can be expected to be part of the other WG's contributions to AR6. [Martine Vanderstraeten, Belgium]	Noted. In the end we decided to remove the headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97435	42	10	42	33	<p>_Solar Radiation Modification: The SRM discussion in the SPM is missing important issues found in the underlying report. We strongly request the authors to include these findings here:</p> <p>1) Key side effects of the various SRM techniques such as: ongoing ocean acidification; Changes to stratospheric chemistry; potential delay in ozone hole recovery and increase in surface UV radiation; potential changes in crop yields; potential disruption to monsoon rainfall; potential changes to urban climate; decrease in sunlight for photosynthesis; less intense global hydrological cycle; effect on ocean circulation and biology; reduction of global mean precipitation ((TS-88:29-31)); uncertain changes to regional precipitation, photosynthetic activity; carbon uptake and biodiversity (Table 4.7 4-81 and 4-82)</p> <p>2) The physical understanding of SRM is very theoretical, since "the assessment is based primarily on idealized climate model simulations." (TS-88:4-5)</p> <p>3) Please see also our detailed comments on TS-88-41 regarding the effect of SRM on global land and ocean sinks.</p> <p>3) Using SRM without deeply reducing emissions will increase the need for even more mitigation and CDR afterwards to reach certain temperature levels. This relation should be also made clearer, as mentioned in the first sentence of D3.1 that SRM cannot undo GHG-induced warming. [Nicole Wilke, Germany]</p>	Not applicable. The part on SRM has been removed from the SPM, to reduce the length of the document.
86495	42	10	42	33	SRM measues are largely untested and unproven to work. This section should highlight this clearly, also there are clearly known geophysical risks, such as reduced NPP, associated with SRM deployment that should more prominently highlighted here. [Ala Taimar, Estonia]	Taken into account. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
87013	42	10	42	33	We seriously question the use of almost half a page in the SPM about SRM. In addition, we percieve the current information in the SPM to be off balance when it comes to providing information about the risks involved globally if potential engagement with SRM activities are pursued. Key side effects of SRM activities needs to be better reflected if SRM are to be presented to policymakers. For instance, risks regarding uneven distribution, dynamical changes, stratospheric changes that might influence ozon recovery and many other issues is not mentioned. There also seems to be redundancy and overlap between the two underlying bullets (D3.1 and D3.2). Please consider if it is necessary to include information regarding SRM in the SPM, maybe a better place would be the Technical Summary. Lastly, it is not clear for us what is ment by "incomplete", and to which reference is SRM "incomplete". This term is used both in the highlighted conclusion and in D3.1. [Oyvind Christophersen, Norway]	Taken into account. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
87275	42	10	42	33	An important issue regarding SRM are the possible induced (regional) climate changes (which might trigger conflicts). This is lacking in section D3 [Marcel Berk, Netherlands]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
104281	42	10	42	34	D3: The discussion could also refer to the energy requirements of SRM and any associated GHG emissions (e.g, through the direct use of fossil fuels or outcompeting other uses of low-emissions alternatives). [Philippe Tulkens, Belgium]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28077	42	10			It is very difficult to retain key messages from Sub-section D3. There are no quantitative findings expressed in the messages, which limits their impact. Some quantitative information given in 4.6 as well as some findings related to changes in precipitation might be reflected in D3. [Eric Brun, France]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
5309	42	10			Section D.2 This section is missing a clear statement that it is unlikely that SRM can simultaneously correct global mean temperature and precipitation [Daniel Murphy, United States of America]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
131843	42	12	42	12	Technical term "masking", not clear, not found in Glossary. Consider using an alternative word [Hans Poertner and WGII TSU, Germany]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
80413	42	12	42	12	Solar Radiation Modification techniques could be briefly mentioned in a footnote to guide a non-specialist public [Paola Arias, Colombia]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
34555	42	12	42	12	Why not include an example or two of solar radiation modification methods for the 'typical' policymaker, who may not be as familiar with such options? [Russell Vose, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
19471	42	12	42	15	The current framing is scientifically accurate but carries a certain connotation. Why does one want to mask all global warming with SRM? The text makes an implicit assumption that SRM should be considered as an alternative to mitigation. Something like "SRM, if used with combination with mitigation, could offset climate risks. But if used at a large scale, it's incomplete" would be more policy-relevant. GeoMIP scenarios do assume large-scale deployment but that's for scientific purposes. For the IPCC assessment, some interpretation is necessary. [Masahiro Sugiyama, Japan]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
19473	42	12	42	15	There are a number of studies that have used an adaptive management framework for SRM deployment (at least the underlying chapter, Chapter 4, cites Kravitz et al. 2016). Compared to other sub-disciplines of climate science, uncertainties remain large for SRM, but there's a way to deal with uncertainty in SRM since it's about societal choice. [Masahiro Sugiyama, Japan]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
9555	42	12	42	15	Summary statement needs to include specific examples of risks of solar radiation modification, especially changes to the water cycle in monsoon regions, rapid warming following abrupt termination of SRM etc (see section 8.6.3). Lines 30-31 of D3.2 should be incorporated in the the summary statement. [Joelle Joelle Gergis, Australia]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
108205	42	12	42	15	The concept of solar radiation masking should be explained in plain language to the target audience of this summary. [Anton Holland, Canada]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
5807	42	12	42	15	I recognize that the headline message must be brief. To me, the first question one should ask of a proposed response to climate change is, "Would it work, at least in a gross sense?" Thus, the bolded sentences in Chapter 4's executive summary, page 8, lines 46-49 seem best: "Solar radiation modification (SRM) can diminish greenhouse-gas-induced warming but is likely to impact climate at regional spatial scales and seasonal timescales (high confidence). There are large uncertainties in important climate processes associated with SRM options and the interactions among these processes (high confidence)." [Jesse Reynolds, United States of America]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
5805	42	12	42	18	The word "mask" is not used in Chapters 4 and 5 to describe SRM's effects [Jesse Reynolds, United States of America]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
130271	42	12	42	33	D.3 addresses geophysical consequences of solar radiation modification (SRM). Adding a brief summary of SRM techniques and a little more detail on serious potential side effects would better inform policymakers. Based on information in Sections 4.6.3 and 5.6.3, consider modifying language in D.3 as follows (new language in CAPITALS): Add information to the pink box summary: ""Masking global greenhouse gas warming through solar radiation modification (SRM) would likely be incomplete, and large residual regional and seasonal climate changes would remain (high confidence). Detailed understanding of the climate response to SRM remains subject to large uncertainties. SERIOUS SIDE EFFECTS INCLUDE INCREASED OCEAN ACIDIFICATION (HIGH CONFIDENCE) AND, FOR STRATOSPHERE AEROSOL INJECTION, DELAYED RECOVERY OF THE OZONE LAYER."" Add a new paragraph immediately after the pink box: ""D.3.1 SOLAR RADIATION MODIFICATION (SRM) METHODS TO REDUCE NET RADIATIVE FORCING OF CLIMATE CHANGE INCLUDE STRATOSPHERE AEROSOL INJECTION (SAI), BRIGHTENING LOW CLOUDS OVER OCEAN AREAS WITH SEA SALT AEROSOL, THINNING CIRRUS CLOUDS WITH ICE NUCLEATION TO ALLOW MORE LONG-WAVE RADIATION TO ESCAPE, AND INCREASING OCEAN ALBEDO WITH REFLECTIVE PARTICLES."" Renumber the current paragraphs D.3.1 and D.3.2 as D.3.2 and D.3.3, and modify the last statement of current D.3.2 as follows: ""SRM would not counteract, AND MAY INCREASE, ocean acidification (high confidence), AND SAI COULD ALSO SLOW THE RECOVERY OF THE STRATOSPHERIC OZONE LAYER."" [Trigg Talley, United States of America]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
53523	42	12			Start the sentence with: "Beyond the ethical, societal and feasibility issues, masking...." (just to recognize that the scientific issues are not necessary the most important facet of this problem) [Hervé Douville, France]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
44021	42	12			Summary for Polcymakers page 42 line 12. The words 'marine cloud brightening' do not appear in a search of the Document. The word 'incomplete' is contradicted by figures S1 and S4 of Stjern at https://www.atmos-chem-phys.net/18/621/2018/acp-18-621-2018-supplement.pdf . This should be compared with the results of doing nothing. [Stephen Salter, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
23427	42	13	42	13	what is meant by incomplete? Does it only mean that "large residual regional and seasonal climate changes would remain" or does it mean something additional? If it just means that I would prefer "incomplete, in the sense that large..." [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
9639	42	13	42	13	How large is large? Large compared to what? Large compared to unmitigated climate change? For what level of SRM? [Olivier Boucher, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
28079	42	13	42	13	Could it be possible to ad a mention of the impacts of high CO2 concentration that would remain? (e.g: ocean acidification and its impacts on biodiversity - I.24) [Eric Brun, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28081	42	13	42	13	How large is large? Large compared to what? Large compared to unmitigated climate change? For what level of SRM? Please develop in paragraph D3.1 [Eric Brun, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
130273	42	13	42	13	What does "incomplete" mean? [Trigg Talley, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
50427	42	13	42	13	Suggested edit for completeness in D3: 'Masking global greenhouse gas warming through solar radiation modification (SRM) would likely be incomplete, not address the impacts of ocean acidification and large residual regional and seasonal climate changes would remain' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
23429	42	14	42	14	Strange formulation "the understanding is subject to large uncertainties". Would it be better by "understanding is hampered by large uncertainties"? [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
90793	42	14	42	14	Write: " ... subject to large uncertainties and environmental risks". [José Romero, Switzerland]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
36291	42	14			Please keep language simple: 'remains subject to' = 'has' ? [Michael PRATHER, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
44023	42	14			Summary for Polcymakers page 42 line 14. There are large uncertainties at the start of almost every useful human activity including the rate at which we can reduce greenhouse gas emissions. Uncertainty might be reason to delay deployment of any technology but is being used as a way to block research which could reduce uncertainty. The UK Government Department at present in charge of climate work cites IPCC reports as a reason for not funding research. [Stephen Salter, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The whole headline statement on SRM + supporting have been removed to shorten the SPM and focus on what matters most to policy-makers.
67681	42	18	42	18	The term SRM more commonly means solar radiation management (not modification) [Karen Rosenlof, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM. SRM no longer mentioned.
28083	42	18	42	18	On plant and soil respiration, isn't it reduce the photosynthesis and enhance respiration? (cf. p4-81 "potential decrease in crop yields"). On increase global land and ocean sinks, isn't it the opposite, refering to upper, (less phosynthesis, more respiration and soil mineralisation) and p4-82 "sea salt deposition on land". So, on SRM we propose to stick to this sentence from the report, p 4-83 line 7-10 "The overall assessment was that the combined uncertainties surrounding the various SRM approaches, including technological maturity, physical understanding, potential impacts, challenges of governance, legality, and potential impacts on sustainable development could render SRM economically, socially and institutionally undesirable." [Eric Brun, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
25977	42	18	42	19	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
5809	42	18	42	19	I suggest that SRM can diminish GHG-induced *climate change*, as it could generally bring changes in precipitation, extreme T and P, and tropical cyclone intensity closer to pre-industrial levels as well. [Jesse Reynolds, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111801	42	18	42	33	It seems that these paragraphs have been written with Stratospheric Aerosol Injection in mind. It would be better to name it explicitly, and also mention Marine Cloud Brightening (and some of its features) because it is quite likely that ongoing experiments in Australia will increase policymakers' interest [Oliver Geden, Germany]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
35285	42	18	42	33	Seriously, imagine the environmental impact statement for Solar Radiation Modification. Imagine the transnational consequences. Imagine the legal tie-ups. Conclusion: SRM is a non-starter and your text should reflect this and put this crazy idea into the ground. [patrick Michaels, United States of America]	Taken into account. Section removed from SPM.
130275	42	18	42	33	1) The effect of sudden SRM implementation/termination is addressed in both D.3.1 and D.3.2. Perhaps these should be combined. 2) The sudden implementation/termination will only have significant effects if it's the sudden implementation/termination of significant levels of SRM. In D.3.2 this is somewhat captured by referencing "gradual phase-out" but, regardless, it needs to be made clear that these statements don't apply to any level of SRM. The latter comment also applies to where such statements are made in the main text (page TS-88, lines 25-27, 36-39, and 44-46). [Trigg Talley, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
36293	42	18			D.3.1 is a very good bullet, but it repeats almost exactly the headline. SPM space is valuable and can be used for new material. Figure out how to modify the headline here. [Michael PRATHER, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
44025	42	18			Summary for Policymakers page 42 line 18. The word 'mask' is used frequently through the reports. It implies something bad remaining behind the mask. This is wrong. The temperature reductions by marine cloud brightening are real. [Stephen Salter, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
8195	42	20	42	20	High confidence in little understanding. =>this is rather confusing language. Suggest phrasing the other way around, little confidence in the processes. [Frank Dentener, Italy]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
5811	42	20	42	21	To be more accurate and to be consistent with Chapter 5 (page 101) and Chapter 4 (page 87), I recommend the "sudden and sustained termination" of SRM [Jesse Reynolds, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
19475	42	20	42	22	The termination shock would be grave if SRM were to be deployed on a large scale, but not so for a limited deployment scenario. [Masahiro Sugiyama, Japan]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
25979	42	20	42	22	More effects on the sudden termination of SRM could be included, to such effect Chapter 5.6.3.4 page 101 could be used. [Don Alfonso Pino Maeso, Spain]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
25981	42	20	42	22	With respect to "sudden changes in the water cycle" it could be added, from chapter 4, page 84, lines 42-44: "There is high confidence that there is a trade-off between reversing temperature and precipitation change through SRM, because precipitation change responds differently to GHG and SRM ERFs". [Don Alfonso Pino Maeso, Spain]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
97437	42	21			Would a sudden termination not also change wind pattern and large scale circulation? [Nicole Wilke, Germany]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
31569	42	22	42	23	"temper the effects of warming on ocean carbon uptake" : On which time-scale after start of SRM ? [Jean-Baptiste SALLEE, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50429	42	22	42	23	D3.1 - Saying both SRM deployment 'could' and then, later in the sentence, 'would thus likely' feels inconsistent - suggest the statements throughout this statement are consistent. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
104283	42	22	42	24	Indicating the effects of solar radiation management on plant and soil respiration is a biased information that does not allow to conclude on the effect on land and ocean sinks. To be more complete and correct, information should be provided on the effects of solar radiation management on photosynthesis, and plant mortality, as well as regions where ecosystem productivity benefits from higher temperatures. [Philippe Tulkens, Belgium]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
50421	42	22	42	24	SRM deployment could reduce plant and soil respiration as well as temper the effects of warming on ocean carbon uptake, and would thus likely increase global land and ocean sinks (medium confidence). Suggest either removing this sentence from SPM, adding 'in theory', or adding a caveat that 'detection and attribution of these effects may not be possible' as these results come from idealised modelling studies, not observations, as is noted in the underlying text (ch4, p87, lines 13-33). It would be useful for policymakers to make it clear that this would be difficult to attribute based on observations alone. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
44891	42	23	42	23	The "increase" should be accompanied with a statement of the possible magnitude, at least with an idea on whether it is a large or small one. [Markku Rummukainen, Sweden]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
89437	42	23			Underlying evidence base for 'increased sinks' is very weak -based on a single study with questionable assumptions. Outcomes are not generalisable. See comment on 5.6.3.3 [Carl-Friedrich Schleussner, Germany]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
28085	42	24	42	24	Please add a mention of biodiversity: "SRM would not counteract ocean acidification and its impacts on biodiversity". [Eric Brun, France]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
44027	42	24			Summary for Polcymakers page 42 line 24. The comment about not reducing ocean acidification is true but irrelevant. Why are we allowed to use only one tool in the box? Should we reject a brilliant idea to reduce acidity because it does not also save Arctic ice? Every tool should be used for what it is good at, in harmony with all the other tools. [Stephen Salter, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
54709	42	27	42	30	Why does this statement need a high confidence qualifier? It is a statement of fact (or so it would seem):"despite progress in understanding.....(there are still) large uncertainties)." [Nancy Hamzawi, Canada]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
69437	42	27	42	33	As described in D.2.2 for CDR measures, providing typical examples of the potential side-effects from SRM measures in D.3.2 would be helpful for policymakers. [Kaoru Magosaki, Japan]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
104285	42	27	42	33	This paragraph is not very conclusive. We strongly recommend to add more detail about SRM impacts and interactions. This is extremely relevant for policy-makers, to inform discussions on the eventual deployment of such techniques. [Philippe Tulkens, Belgium]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
8197	42	28	42	38	High confidence in little understanding. =>this is rather confusing language. Suggest phrasing the other way aournd, littlle confidence in the processes. [Frank Dentener, Italy]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by a

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
23431	42	29	42	30	Is it necessary to use confidence language when stating that something is uncertain? Essentially the sentence says: "There is high confidence that there are large uncertainties" [Anna Amelia Sörensson, Argentina]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
36295	42	29			suffer from' - it looks like the subject is singular 'understanding', otherwise, is 'interaction' the other compound subject? Either way, they do not 'suffer'. [Michael PRATHER, United States of America]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
77101	42	30	42	33	What does rapid mean here? Years, decades? [Emer Griffin, Ireland]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
25983	42	30	42	33	It could be added as effects of sudden termination of SRM not only increase of global warming but also increase of precipitation, sea level rise and reduction of sea ice, as stated in Chapter 4, page 87, lines 14-16: "As assessed in AR5, a hypothetical, sudden and sustained termination of SRM would cause a rapid increase in global temperature, precipitation and sea level rise, and rapid reduction in sea ice area and Atlantic meridional overturning circulation (high confidence)." [Don Alfonso Pino Maeso, Spain]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
50419	42	30	42	33	"There is high confidence, as assessed in AR5, that a sudden and sustained termination of SRM would cause a rapid increase in global warming, but a gradual phase-out of SRM combined with mitigation and deploying global scale net CDR would likely avoid these large rates of warming. {4.6.3, 5.6.3, 8.5.3, 8.6.2, 8.6.3}." It would be helpful to provide further information to unpack the second half of this statement, including details/quantification of the balance between a 'gradual phase-out' (including specifying what a gradual phase-out means) and the level of mitigation/CDR that is involved to avoid large rates of warming. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
44029	42	30			Summary for Policymakers page 42 line 30. If marine cloud brightening was stopped the local effects would be cancelled in a few days. This could be an attractive feature and might be needed following a volcanic eruption. The computer models show that global conditions would get back to where we would have been without geoengineering in 10 years. This is plenty of time to repair or replace spray vessels. I would be very strongly against any technology which was irreversible. [Stephen Salter, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
78665	42	33	42	33	Shouldn't it still be said explicitly here that nevertheless, warming would still occur? [Heike Wex, Germany]	Not applicable. Section removed, to shorten the SPM and focus on the most relevant results of the SPM.
130277	42	36	42	36	Maybe there should be a mention of needed observational capabilities to measure the changes and impacts to climate due to mitigation/adaptation strategies. [Trigg Talley, United States of America]	Rejected. We do not have the literature to support such a statement.
117253	42	36	43	20	could something be said about going back to pre industrial temperatures? [Maisa Rojas, Chile]	Rejected, none of the future scenarios project a decrease of the temperature below the current level. This section of the SPM is based on the projections in the 5 illustrative scenarios and the detection of the benefits for various parameters resulting from low emissions trajectories compared with high emissions trajectories. Going back to pre industrial temperature is beyond this scope.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104287	42	36	43	20	D4. the fact that cuts in long-lived forcer emissions are not immediately noticeable in temperatures does not require a whole section. Consider merging key messages with D1.3 & D3 (i.e. a dedicated section on non-CO2) [Philippe Tulkens, Belgium]	Rejected, the section also discusses the benefit of low emissions trajectories on non-CO2.
104289	42	36	43	20	Information provided in subsection D.4 about CO2, methand and short-lived climate forcers, should be completed for other non-CO2 gases, including NO2 and HFC. [Philippe Tulkens, Belgium]	Taken into account, the section D2 in the final SPM considers the GHG as a whole not only CO2.
69843	42	36	43	20	This summary appears to ignore the effect of different emissions pathways on climate extremes by only discussing global average temperature. The implication is that mitigation pathways are not detectably different in the near term. This contradicts the findings with respect to climate extremes, as discussed in Chapter 4: 4-76, L29-44. ("Using large 40 ensembles, Tebaldi and Wehner (2018) found that statistically significant differences between RCP4.5 and 41 RCP8.5 in extreme temperatures over all land areas become pervasive over the globe by 2050.") [Gabrielle Dreyfus, United States of America]	Taken into account, the section D2 in the final SPM discusses the detection of effects on climate impact drivers such as dangerous heat thresholds depending on the emission pathways.
67683	42	37	42	43	Interannual variability can both reduce or increase a calculated trend. I don't thing "temporarily masked" it the coreect terminology. The issue is when the signal emerges above the noise in a variable world. This applies to the subsequent paragraph as well. [Karen Rosenlof, United States of America]	Taken into account. The wording has been changed, explaining the concept instead.
34707	42	38	42	38	Reduction of emissions REDUCES global warming (compared to a growth path!) - in order LIMIT it, they need to be reduced to zero. [Petra Seibert, Austria]	Accepted. Text revised accordingly.
9759	42	38	42	43	D.4 needs careful presentation otherwise it can be twisted as "even the IPCC admits that mitigation won't show any results for over a quarter of a century/three decades" [Jonathan Lynn, Switzerland]	Taken into account, the section D.2 in the final SPM deals with discernibility of the effects of the low emissions pathways at different timescales. The benefits are presented in their order of detectability after the start of strong climate change mitigation (as considered in the 5 illustrative scenario used in WG1).
38979	42	38	42	43	Suggestion not to use the conditional "would" in this paragraph (instead "limits", "is temporarily masked", "will be" or "is"). These are general processes, aren't they? [Maïke Nicolai, Germany]	Rejected, all the statements describing future projections are written with the conditional form.
9557	42	38	42	43	Very long and uncelar sentences. Some people might view this statement very cynically as 25-30 years is a very long time in a policy context. Needs to be phrased more clearly for a policy audience. The idea that even with strong policy the benefit of emission reductions will only be clear after 25-30 years for the global average and in 80 years for regional areas is not very motivating. Perhaps this statement needs to be reframed in terms of the benefit of mitigating quickly vs continued delay. [Joelle Joelle Gergis, Australia]	Taken into account. The phrasings have been simplified, and the framing changed to 'decades or more'. This is what the science says, so we cannot make the main conclusion.
90225	42	38	42	43	We propose to shorten this headline statement as follows "Reductions in greenhouse gas emissions would limit globally averaged surface warming, but the resulting slowdown in warming would be temporarily masked by natural year-to-year variability (high confidence), as well as by additional warming due to reductions of cooling aerosols. The detection time of mitigation benefits for surface air temperature would therefore be about 25–30 years for the global mean and near the end of the century at regional scales (medium confidence)." Additionally we are wondering if there are not regional signals of climate change to detect reduction in GHG emissions. If this is the case, it should be highlighted in this headline messages. [Georges Gehl, Luxembourg]	Taken into account, though not word by word. HS14 (previously D.4) now reads "Stringent reductions of CO2 and non-CO2 emissions will lead to discernible effects on atmospheric composition and air quality within years. By contrast, the effects on other variables, such as surface temperature, will emerge only after decades or more."

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34997	42	38	42	43	The SOD admits that even severe mitigation will not cause any detectable reduction in GSAT in the next 25-30 years. Please see general comment #14 above. [Jim O'Brien, Ireland]	Rejected. Indeed, no mitigation would cause reduction in GSAT over the next decades. We assume the comment refers to rates of GSAT change. However, here, the comment is also incorrect, in that D.4 refers to the interplay between natural variability and the human induced warming rate. The latter is rapidly affected; we're writing about the net effect of the two.
86497	42	38	42	43	Red Box - this box should also include the immediate changes detected/mitigation benefits, otherwise it gives a very biased picture. [Ala Taimar, Estonia]	Taken into account. The revised text notes this point.
50423	42	38	42	43	Near the end of the century' is not a detection time - this is a pathway-specific date depending on when emissions reductions are implemented, and suggest this should therefore be changed to 'and longer at regional scales' to be accurate. Alternatively, the '25-30 year' figure could be changed to a date (presumably 2045-50) if this sentence were prefaced with 'For pathways consistent with limiting warming to 1.5C or 2C by 2100'. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The text has been changed.
87015	42	38	43	2	The message that emission reductions would only be detected after 25-30 years is a very negative message for policy makers. It seems unnecessarily pessimistic in light of the improved tools for observation, analysis and assessment that is highlighted other places in the report. E.g. IPCC reports themselves would capture changes in policy and emission reductions faster than 25-30 years. The text could be misunderstood or potentially mis-used if taken out of context. It should be specified clearly also in D.4.1 that the paragraph refers to detection of the slowdown in warming resulting from reductions in greenhouse gas emissions and strictly separated out from natural variability, and not to the difference in warming under a low emission and a high emission scenario, which will be large by the end of the century. [Oyvind Christophersen, Norway]	Taken into account. The revised text clearly notes that the point relates to surface warming rates specifically, and that anthropogenic climate influence in general is affected long before emission reductions would be visible in observed rates.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130279	42	38	43	20	D.4 accurately states that it will take 25 years or more to see the effects of GHG emissions reductions on global temperature and other aspects of climate change. However, as currently framed, the pink box summary could lead some policymakers to rationalize that it is not worth the shorter-term economic costs and adjustments to undertake aggressive emissions reduction efforts, or to implement policy toward that goal. Even though reducing anthropogenic aerosols (fine particulates and other near-surface air pollutants) does initially result in a little more warming, mitigating these pollutants is vitally important to human health and to the overall well-being of agricultural and natural ecosystems -- and thus to agricultural and society-wide resilience to climate change impacts. This consideration should be succinctly added to the summary (page 42, lines 38-43) in order to encourage policymakers to undertake effective action to reduce GHG and pollutant emissions. Suggested revision (new language in CAPITALS): "Reductions in greenhouse gas emissions would limit globally averaged surface warming, but the resulting slowdown in warming would be temporarily masked by natural year-to-year variability (high confidence), as well as by additional warming due to reductions of cooling aerosols (FINE PARTICULATES AND OTHER AIR POLLUTANTS) -- even when accompanied by reductions in other short-lived climate forcers. The detection time of mitigation benefits for surface air temperature would therefore be about 25-30 years for the global mean and near the end of the century at regional scales (medium confidence). HOWEVER, THE PUBLIC HEALTH BENEFITS OF REDUCING NEAR-SURFACE AEROSOL EMISSIONS WILL ACCRUE PROMPTLY, THEREBY ENHANCING AGRICULTURAL AND SOCIETAL RESILIENCE TO THE IMPACTS OF CLIMATE CHANGE." [Trigg Talley, United States of America]	Taken into account, although with somewhat different wording than what is suggested here. The revised text clearly notes that the point relates to surface warming rates specifically, and that anthropogenic climate influence in general is affected long before emission reductions would be visible in observed rates.
107791	42	38			The covid-19 will lead to a unprecedented decrease of CO2 emissions by 2020. As long as it has never been experienced before, is there a risk that this decrease will alter the models used for calculating the pathway of the long-term increase trend ? [FREDERIC MENARD, France]	Taken into account, a summary of the effects of the measures to reduce spread of COVID-19 is given in the final version of the SPM (D2.1).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
89439	42	38			<p>The premise on which this question of ‘detection of mitigation’ is being assessed and presented here in D4 also in the underlying chapter and some of the respective literature is not very convincing and dangerously misleading for policy as it seems to imply that we would not see benefits from mitigation. Which is incorrect. We will and very directly so – just the question of the right counterfactual needs to be addressed.</p> <p>What is done commonly in climate science is to assess when the forced signal emerges beyond natural variability. So the reference case is a stable climate and then the null hypothesis is robustly rejected that the trend itself can be explained by natural variability alone.</p> <p>However, for detecting the effects of mitigation, the question is a different one. It is about the ability to detect the GHG signal all other things being equal (meaning multi-decadal modes of natural variability, for example). It is not about “when does the mitigation signal emerges beyond natural variability” – the Tebaldi and Friedlingstein approach from 2013 -predating most of the attribution science that is very commonly done today.</p> <p>The question at hand is indeed more similar to probabilistic approaches that are used in extreme event attribution. There we do assess partial contributions of climate change and do not only assess climate change footprints extremes if they were 100% attributable. This has also been done by one of the papers cited (Marotzke 2019) that shows that the probability for a near-term warming trend reduction (2021-2035) compared to the recent past under a RCP2.6 scenario is 67% and thereby 40% higher than in a RCP4.5 scenario. There is such a clear mitigation signal to be expected even in the presence of natural variability that directly contradicts with the ‘high confidence’ statement here.</p> <p>The premise that authors have worked on here to me more seems to be like:</p>	<p>Taken into account. While we do not fully agree with the points made here; indeed the question at hand is in fact when we can be certain that the effects of mitigation will be visible in the metrics most often used by the policy community; the phrasing has been changed in a way that is consistent with what is being asked. HS14 (previously D.4) now reads "Stringent reductions of CO2 and non-CO2 emissions will lead to discernible effects on atmospheric composition and air quality within years. By contrast, the effects on other variables, such as surface temperature, will emerge only after decades or more."</p>
36297	42	38			D.4. This headline should really just be the last sentence. But it needs some contrast from the 2nd bullet. [Michael PRATHER, United States of America]	Taken into account. The order of the points has been changed.
25985	42	39	42	39	Instead of "natural year-to-year variability" it would more appropriate to use "natural internal variability" as used in Chapter 4, page 8, line 19. [Don Alfonso Pino Maeso, Spain]	Not applicable. The text has been changed.
53525	42	39			masked by former emissions and by natural variability? (to highlight that the rate of warming does not scale instantaneously with GHG emissions) [Hervé Douville, France]	Not applicable. The text has been changed.
50431	42	40	42	40	The message may be interpreted here as: 'burn more coal to keep it from warming as much in the short term' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. This is clearly not what is intended; we have kept the comment in mind for the revision.
80175	42	41	42	43	Also see Page 43, lines 1-2. We do not fully agree with this statement. Also, it is not clear what does after 25-30 years mean: after 2015 when the scenarios start, or from 2020? Globally around mid-2040 the mitigation effects can be seen with 1.9 scenario and it is very much region-dependent when the mitigation can be sensed, but earlier than the end of the century. Also, it would worth measuring the continental scales too. At last, the mitigation effectiveness very much depends on when we start doing it with what magnitude and apparently which scenario we follow though. [Lilian Fejes, Hungary]	Taken into account. The text has been substantially revised, and the formulations referenced here have been changed.

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93779	42	41	42	43	This statement is based on a specific emissions scenario, please indicate which one(s) is/are referred to, similarly to D4.1. This will also give more context to understand the phrase "near the end of the century". [Quentin Lejeune, Germany]	Taken into account. The statement is true for the most extreme difference in emissions considered here, which is now specified in HS14.3 (previously D4.1).
111699	42	41	42	43	I think this sentence needs some work. First, what is the counterfactual or null hypothesis assumed? (e.g. the current rate of emissions continuing, or some assumed alternative scenario of increasing emissions?). Secondly, what is the level of confidence you are requiring for detection? If it is say 95%, I would argue that for policy relevance a much lower confidence level is needed (e.g. 66%). We would just want to know that the mitigation measures were probably working. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The statement has been revised accordingly.
99999	42	41			This statement on the detection time is unclear. What is being detected here? And what about methods to detect the anthropogenic warming component (like the globalwarmingindex of Oxford University)? [Caroline Eugene, Saint Lucia]	Taken into account. The statement(s) now refer to emergence, as used elsewhere in the report. The GlobalWarmingIndex is based on an emission to forcing to response calculation, and is thus different to an observational based emergence. No less useful, but the point here is about the level of natural variability in the global surface temperature metric itself, as it is being used currently.
68821	42	41			Please clearly explain the statement on the detection time. For example, what is being detected and what about methods to detect the anthropogenic warming component (like the global warming index of Oxford University)? [Jeffers Cheryl, Saint Kitts and Nevis]	Taken into account. The statement(s) now refer to emergence, as used elsewhere in the report. The GlobalWarmingIndex is based on an emission to forcing to response calculation, and is thus different to an observational based emergence. No less useful, but the point here is about the level of natural variability in the global surface temperature metric itself, as it is being used currently.
8199	42	42	42	43	Memtion how the mitigation strength factored in this 25-30 years? [Frank Dentener, Italy]	Not applicable. The text has been changed.
104291	42	42	42	43	Mention how the mitigation strength factored in this 25-30 years. [Philippe Tulkens, Belgium]	Not applicable. The text has been changed.
44921	42	42	42	43	The "detection time of mitigation benefits" is somewhat cryptic. What is the implied detection level / likelihood? It might also be useful to remind that the journey to "detection" is of course initiated when mitigation occurs. I.e., the effect starts unfolding much sooner. [Markku Rummukainen, Sweden]	Taken into account. The text now refers to emergence, as defined and used elsewhere in the report (and SPM).
25987	42	45	42	45	For the same reason as above, we would suggest replacing "natural variability" for "natural internal variability". [Don Alfonso Pino Maeso, Spain]	Not applicable. The text has been changed. (And note that internal and natural variability have distinct, specific meanings in this report. Natural variability includes solar variations, for instance, while internal variability is only internal to the Earth's climate system.)
42293	42	45	42	49	D4.1: Could this be described in terms of emergence, which is defined in box SPM1. [Tina Christensen, Denmark]	Taken into account; this is now done throughout HS14 (was D4)
117251	42	45	43	2	Can something be said about the relationship between emissions reductions and atm GHG concentrations? Do the trends in surface air temp depend on atm. CO2 concentrations? [Maisa Rojas, Chile]	Taken into account. The revised phrasing notes that "Stringent reductions of CO2 and non-CO2 emissions will lead to discernible effects on atmospheric composition and air quality within year".

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104293	42	45	43	2	Extremely important paragraph for policy-making. Some could say that mitigation efforts are useless, because the effects are not immediate. It is important to keep this conclusion. [Philippe Tulkens, Belgium]	Noted. Thanks.
7725	42	48	43	2	The sentence " Even for pathways with rapid decreases to net-zero and negative CO2 emissions consistent with keeping warming to 1.5°C or 2°C, trends in surface air temperature would only be detected after 25–30 years globally and near the end of the century at regional scales" needs some fine tuning because trends in temperature change can always be detected, independent from trends in emissions. However, inserting "a change in current" before "trends in surface temperature" would convey the right message. [Klaus Radunsky, Austria]	Taken into account. The text has been substantially revised.
116129	42		42		Could section D2 expand on findings from SRCCL on biophysical effects related to land use? [Valerie Masson-Delmotte, France]	Rejected - unfortunately, due to space constraints, this discussion cannot be added to the SPM, but is available in the underlying Chapter 5, Section 5.6
38981	43	1	43	1	Suggestion to replace the conditinal "would" by simple future "will". [Maïke Nicolai, Germany]	Not applicable. The text has been changed.
38983	43	4	43	11	Suggestion to replace the conditional with simple future or simple present. [Maïke Nicolai, Germany]	Not applicable, the sentence deals with future projections according to scenario, the conditional is used most of the time in such case.
36299	43	4			D.4.2 is wrong. These numbers make no sense. (1) long-lived gases like CO2 and N2O are monitored very well and changes in emissions on global scales using modern inversion techniques could easily see reduction in a few years. For SLCF, changes occur within a year but really cannot be detected within a year because of the interannual variability, probably about 5 years also. [Michael PRATHER, United States of America]	Taken into account, the statement D2 says in the final version of the SPM "Scenarios with low or very low GHG emissions lead within year to discernible effects on GHG and aerosols concentrations (...) relative to high and very high GHG emissions scenarios."
86605	43	6	43	7	Detection of changes in CO2 emissions in atmospheric CO2 will highly depend on the level of CO2 reduction. The 10-15 years window you report must be for a given mitigation rate (as in Peters et al. Nature CC 2017 with 1% per year). It wouldn't take 10-15 years to see a 5% drop per year. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account and clarified, here the discussion is based on the 5 illustrative scenario used in AR6 WG1. The statement D2 says in the final version of the SPM "Scenarios with low or very low GHG emissions lead within year to discernible effects on GHG and aerosols concentrations (...) relative to high and very high GHG emissions scenarios."
69439	43	7	43	7	"ten to fifteen years" is used here instead of "10-20-year time scales" in the Executive Summary of Chapter 6. The same values from each chapter should be used. [Kaoru Magosaki, Japan]	Not applicable as, in the final version of the SPM, the time response evocated for SLCF or GHG is not the absolute time response of their concentrations following a reduction but their time response to mitigation policies (which includes the time to effectively implement the policies).
69441	43	9	43	9	The phrase "most strongly near areas where emissions of these compounds are reduced" in 6.5.1, 6.5.2 or 6.6.3. lacks paper citation. It would be helpful if the reference is revised. [Kaoru Magosaki, Japan]	Taken into account, it has been removed from the final SPM version.
69443	43	10	43	10	"in less than a year" is used here instead of "within days to decades" as in Chapter 6. The same values from each chapter should be used. [Kaoru Magosaki, Japan]	Not applicable as, in the final version of the SPM, the time response evocated for SLCF or GHG is not the absolute time response of their concentrations following a reduction but their time response to mitigation policies (which includes the time to effectively implement the policies).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
104295	43	10	43	10	As interannual variability is also important for ozone and aerosol, detection will need at least a couple of years, in particular because emissions will not change abruptly. [Philippe Tulkens, Belgium]	Taken into account, the time response evoked for SLCF is longer in the final SPM (D2.2) as it corresponds to the time response of concentration to mitigation policies (which includes the time to effectively implement the policies).
77615	43	10	43	17	Could this section be expanded to include impacts of other GHG [Emer Griffin, Ireland]	Rejected. We do not have the literature to support such a statement.
44893	43	13	43	13	Especially the "CO2 ... emissions" affect climate on much longer time scales than a decade or two. Please adjust as appropriate. [Markku Rummukainen , Sweden]	Taken into account. The paragraph has been revised and the key point has been included in D1.7 in the final SPM.
7727	43	13	43	14	It is suggested to delete "on time scales of a decade or two" because the life time of CO2 and CH4 differ considerable. [Klaus Radunsky, Austria]	Taken into account. The paragraph has been revised and the key point has been included in D1.7 in the final SPM.
41353	43	13	43	14	I may misunderstand this sentence, but the CO2 statement appears to be plain wrong as there has to be a qualifier that the CO2 warming contribution persists for much longer than a decade or two. For WGI, this kind of "decade or two" statement is way too vague and imprecise in any case. [Alexander Nauels, Germany]	Taken into account. The paragraph has been revised and the key point has been included in D1.7 in the final SPM.
77103	43	13	43	16	What about N2O and other GHGs? [Emer Griffin, Ireland]	Noted. reductions in N2O and GHGs are needed to limit temperature as noted in the headline statement in section D of the final SPM.
50433	43	13	43	20	The warming mentioned in D4.3 is stated as 0-0.3C, which is inconsistent with that stated in the executive summary of chapter 6, where it is stated at 0.05-0.3C. Do these both use GSAT? Please could you clarify if this is the reason for the difference/ensure consistency across the report. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The paragraph has been revised and the key point has been included in D1.7 in the final SPM.
109315	43	13	43	20	The logic of this paragraph could be clearer. What is the link between the second sentence and the first one, and the second sentence and the third one? I think you're saying that all scenarios for SLCFs lead to short-term warming, but by lumping long-lived CO2 and short-lived methane together in the first sentence, you've clouded that issue, and by putting methane (positive forcer) together with aerosol SLCFs in the second sentence, you seem to imply that methane reductions per se would *raise* temperatures. After reading the paragraph several times I think I understand it, but please clarify. [Paul Edwards, United States of America]	Accepted. This paragraph has been revised and the key point about the contribution of short-lived forcers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
50435	43	13	43	20	It is important to give some context for the reasons for the warming detailed in D4.3 and to help the reader understand the interplay between aerosols and warming SLCFs. Adding "For the mitigation scenarios SSP1, the likely near term warming of 0.05-0.3°C is predominantly due to sulphate aerosol reduction and the peak warming from the SLCFs occurs before 2040. After 2040 the reduced warming from reductions in methane, ozone and HFCs dominates and at the end of century the temperature change due to SLCFs is close to zero. For the low climate mitigation scenarios SSP3-7.0 and SSP5-8.5, the aerosols are less important and methane, tropospheric ozone and HFCs are the main warming agents." (as stated in the executive summary of chapter 6) would be helpful here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This paragraph has been revised and the key point about the contribution of short-lived forcers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28087	43	13	43	20	Several points are mingled in this paragraph, which as a result is unclear. [Eric Brun, France]	Accepted. This paragraph has been revised and the key point about the contribution of short-lived forcings (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
86499	43	13	43	20	D4.3 this is a very important section and conveys a clear message, particularly the last sentence. Perhaps it could also include some specific information on the contribution of methane. [Ala Taimar, Estonia]	Taken into account. The contribution of methane to future warming has been clarified in D1.7 in the final SPM.
130281	43	13	43	20	Recommend removing D.4.3. It doesn't directly discuss detecting emission reductions, the section topic. Moreover, the radiative impact of CO2 has already been discussed elsewhere. [Trigg Talley, United States of America]	Rejected. This paragraph has been revised and the key point about the contribution of short-lived forcings (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
34557	43	13	43	20	It's not clear how D.4.3 relates to the larger theme of D.4 (Detecting the effect of emissions reductions). [Russell Vose, United States of America]	Taken into account. This paragraph has been revised and the key point about the contribution of short-lived forcings (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM which sits under the theme of Limiting Future Climate
36301	43	13			D.4.3 makes no sense to me. What is CO2 doing here and as the lead in the bullet? Why not N2O? If this is just a CH4 attrib to T change then say it. The last line is NOT correct, assuming that SLCFs and N2O continue to be emitted then there is an offset of global mean T from that due to CO2 alone. Yes, CO2 is the dominant long-term forcing, but N2O is also long term. The SLCFs+N2O shift the warming by 0.3C (Fig SPM.10), so why does this bullet go back to CO2, it should say how much the non-CO2 gases shift the climate. 0.3C could be a lot to some. [Michael PRATHER, United States of America]	Taken into account. The paragraph has been revised and the key point has been included in D1.7 in the final SPM.
65645	43	14	43	17	Need to provide quantitative data for both methane and carbon dioxide for the same period in this paragraph. If non-CO2 emissions will increase GSAT by 0.0 - 0.3C between 2020 and 2040, what impact will carbon dioxide have over this same period? Based on C1.3, which shows projected temperature increases of approximately 0.1-0.9C over this period, it suggests that CO2 will contribute around 0.1C-0.6C. [Kushla Munro, Australia]	Rejected. This paragraph has been revised and the key point about the contribution of short-lived forcings (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.. For sake of brevity, we do not provide numbers here but link to the appropriate sections in the Technical Summary and Chapter 6 where more quantitative information is provided
25995	43	14	43	17	According to chapter 6, page 78, lines 42-45 (As it is shown in Figure 6.19 (see Section 6.6.4) in all SSP scenarios the SLCFs give a positive contribution to global surface air temperature (GSAT) ranging from 0.05 °C to 0.2 °C in the near-term until 2040, being relative insensitive across the SSPs due to compensating effects of warming (CH4, O3, BC snow) and cooling agents (aerosols)", the figures for the warming caused by SCLCFs (0.05 °C to 0.2 °C) are slightly different than the ones stated here (0°C-0.3°C). [Don Alfonso Pino Maeso, Spain]	Taken into account. Thank you for bringing this to our attention. We have now ensured that the revised paragraph (D1.7 in the final SPM) is consistent with the quantitative information in Chapter 6 (figure 6.22) and the Technical Summary (TS Box 7)
130283	43	14	43	17	If the term "warming" is used for what happens, then it should be "increases in emissions" (not changes). [Trigg Talley, United States of America]	Rejected. Reductions in emissions of aerosols causes warming. Therefore, we have used emissions "changes"

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44895	43	15	43	16	The "changes in emissions" is unclear. Increasing emissions cause warming (if not dominated by sulphur dioxide which is not explicitly mentioned here), and reduced emissions a cooling. Please specify what "change" implies. [Markku Rummukainen, Sweden]	Taken into account. This paragraph has been revised and the key point about the contribution of short-lived forciers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
111489	43	15	43	17	In this sentence, it really isn't clear what's being talked about. The SLCFs include warming and cooling influences, and "changes" can be increases or decreases. To understand the relative warming range quoted, it would help to explain what we're talking about - decreases in methane etc AND in aerosols? [James Renwick, New Zealand]	Taken into account. This paragraph has been revised and the key point about the contribution of short-lived forciers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
87017	43	15	43	17	The sentence refers to "changes". What types of changes? Changes could refer to both an increase and/or decrease. Instead of changes, please use increase/decrease where possible. [Oyvind Christophersen, Norway]	Taken into account. This paragraph has been revised and the key point about the contribution of short-lived forciers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7. in the final SPM.
17731	43	16	43	17	Information of how changes in emissions of short-lived climate forces will affect globally averaged surface temperature after 2040 is missing. [Anette Jönsson, Sweden]	Taken into account. Both short-term and long-term changes are discussed in the revised D1.7 in the final SPM.
104297	43	16	43	17	Clarify the reasons for the expected relative warming and specifically the role of methane. [Philippe Tulkens, Belgium]	Taken into account. The role of aerosols and methane in future projections has been clarified in the revised D1.7 in the final SPM.
44923	43	16	43	17	It would be useful to also mention about the significance / effect of changes in SLCF after 2040, to complete the picture. [Markku Rummukainen, Sweden]	Taken into account. The revised paragraph D1.7 in the final SPM mentions both short and long-term effects from changes in methane, aerosol and ozone precursors.
50437	43	16	43	18	Please clarify here the different timescales the SLCFs listed here act on and their radiative forcing, i.e. aerosols (days; negative forcing) and methane etc. (decades, positive forcing). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Noted. See D1.7 in the final SPM.
69445	43	17	43	17	"0°C" is used here instead of "0.05°C" as in Chapter 6. It would be better to cite the same/consistent values from each chapter unless there are particular reasons to do otherwise. [Kaoru Magosaki, Japan]	Taken into account. Thank you for bringing this to our attention. We have now ensured that the revised paragraph (D1.7 in the final SPM) is consistent with the quantitative information in Chapter 6 (figure 6.22) and the Technical Summary (TS Box 7)
81925	43	17	43	20	We support that D.4.3 looks at the short-term impact of short-lived GHG gases. However, it would be useful to clarify what timeframe is meant by "long-term". [Dan Zwart, New Zealand]	Noted. The long-term refers to the period 2081-2100 as clarified in the preamble of Section B of the final SPM.
80177	43	17	43	20	It is not fully understood if this 0 to 0.3 °C warming is due to methane only or it is excluded from it as a "short-lived" forcer and without it we can achieve that low warming. Also, methane is 12 years in the atmosphere, it could be called a rather short-lived forcer but would not use days. [Lilian Fejes, Hungary]	Rejected. This paragraph has been revised and the key point about the contribution of short-lived forciers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
41269	43	18	43	18	It is not clear what "effect" is referred to here and hence what "within days" means. I agree for concentration and forcing but strongly disagree for temperature and sea level rise. [Keith Shine, United Kingdom (of Great Britain and Northern Ireland)]	taken into account. This paragraph has been revised and the key point about the contribution of short-lived forciers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7729	43	18	43	19	The sentence lacks clarity. Thus it is suggested to add "reduction" after "emissions" so that the sentence reads: Because the effect of short-lived climate forcers decays rapidly – within days to decades after emission reduction – the net long-term global temperature effect from all anthropogenic emissions is predominantly determined by CO ₂ ." The effect of short-lived climate forcers on global warming would not change unless there is a change in their emissions! [Klaus Radunsky, Austria]	taken into account. This paragraph has been revised and the key point about the contribution of short-lived forcers (specifically, methane, aerosol and ozone precursors) to future warming has been clarified in D1.7 in the final SPM.
42291	43	18	43	20	D4.3 L18-20: Clear and important message. [Tina Christensen, Denmark]	Thank you!
25989	43	18	43	20	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed for statements of facts or when quantified uncertainties are provided.
17859	43	18	43	20	I would specify that the net long term effect on climate from _today's_ emissions is predominantly due to CO ₂ , but note that continued emissions of SLCFs lead to continued climatic impacts. [Marcus Sarofim, United States of America]	Taken into account. This paragraph has been revised to focus only on the contribution to future GSAT changes from SLCF emission changes.
50497	43	20	43	20	Suggest that the following is added to the end of D4 (Line of sight: from 6.5 and the amended summary of chapter 6): 'Achieving Paris Agreement goals, including limiting warming to 1.5°C, requires simultaneous and ambitious reductions of SLCFs and LLGHGs within the next decades (6.5).' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	rejected. Chapter 6 did not specifically assess the contribution of SLCF reductions to limiting warming to 1.5. It, however, assessed two illustrative scenarios which were compliant with Paris agreement goals.
65073	43	23	44	22	I find this entire section misplaced, since this report concerns the scientific basis not mitigation [Magnus Joelsson, Sweden]	Accepted. Content of former D5 is now presented much more succinctly and integrated in HS11 and HS14.
7731	43	23	44	22	D.5: It is noted that the current text lacks clarity. However, the executive summaries of relevant chapters (6, 10, 11 and 12) include clear wording. Thus it is recommended to build stronger on those executive summaries and not to change that wording significantly. Some concrete examples are provided below. [Klaus Radunsky, Austria]	Taken into account. Subsection significantly reorganised : the important information is now distributed in HS11 and HS14 (which are in the sections linking to WGII and WGIII, respectively). Moreover, the clarity of the text has been improved.
90227	43	23	44	22	As already said in our comment on the overall structure of the SPM, we consider that this sub-section is not-policy relevant and very technical and can thus be deleted from the SPM and move to the TS. [Georges Gehl, Luxembourg]	Taken into account. Content of former D5 is now presented much more succinctly and integrated in HS11 and HS14.
78989	43	23	44	22	This section D5 could be much shorter. This section is not about what WG 1 is usually doing. [Martine Vanderstraeten, Belgium]	Accepted. Content of former D5 is now presented much more succinctly and integrated in HS11 and HS14.
90795	43	23	44	22	Section D.5 Climate information and societal linkages could be better placed in the report of WG II of the one of WG III. [José Romero, Switzerland]	Taken into account. Subsection significantly reorganised : the important information is now distributed in HS11 and HS14 (which are in the sections linking to WGII and WGIII, respectively). Moreover, the clarity of the text has been improved.
54717	43	23	44	23	In section (D.5) there is a mix of statements - on the one hand the discussion is about information, collaborative learning and knowledge production and then, on the other hand, there are statements about impact drivers and air quality. For consideration, the structure could be revisited for better flow and logic. [Nancy Hamzawi, Canada]	Accepted. Content of former D5 is now presented much more succinctly and integrated in HS11 and HS14.
28089	43	23			Why is air quality and health the only societal linkage mentioned in this paragraph? It would be logical to have a paragraph on other societal linkages. [Eric Brun, France]	Not applicable. Societal linkages not explicitly mentioned in revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
108275	43	25	43	26	This first sentence is at best meaningless. The reader should decide themselves what they find useful. it should be omitted. [Johannes Quaas, Germany]	Taken into account. "Useful" is no longer used in the revised SPM.
53527	43	25	43	32	May be add that "Improved adaptation to natural climate variability will be generally useful to adapt to climate change." (at least from a water cycle perspective where climate change may primarily manifest as an increase in variability and extremes)? [Hervé Douville, France]	Not applicable. This part of the SPM has been significantly restructured and rewritten.
9559	43	25	43	32	Phrasing of this summary satement needs work to improve clarity and grammar. What is meant by sectoral assets? Suggest giving specific examples The phrase 'over the next decades' should be changed to in coming decades, in the short term or similar. I think the main message is that climate information helps communities adapt to climate change. Suggest simplifying the lanaguage here. [Joelle Joelle Gergis, Australia]	Taken into account. All the headline statements have been significantly revised. They are now much shorter and easier to understand by lay people.
130285	43	25	44	22	D.5.4 succinctly states the biggest social challenge facing effective action on climate change: ""It is virtually certain that complex climate change information is understood differently by different groups of people."" Unfortunately, there are many decisionmakers who will interpret the data summarized in the SPM to suggest that efforts to reduce emissions or enhance carbon dioxide removal (CDR) through natural processes are not cost-effective because they will not significantly change the global temperature curve or other climate indicators in the next couple of decades. Thus, it is vital that the SPM clearly outline three key messages: (i) the urgency of the climate situation; (ii) the long-term efficacy of mitigation efforts in preventing catastrophic change by the end of the century; and (iii) the more immediate benefits to public health, agriculture, and community resilience of aggressive efforts to reduce all air pollutant emissions and optimize agricultural and land management practices for CDR and soil and ecosystem health. This can be accomplished in D.5 by adding a few key phrases (in CAPITALS) to the pink box summary and to paragraph D.5.4, as follows: Summary: ""Useful climate information for vulnerability, impacts, adaptation AND MITIGATION, and climate service applications depends on the regional context and sectoral assets in focus. Irrespective of the emission pathway that is followed, multiple climatic impact drivers will continue to change over all regions over the next decades as well as the longer course of the century (high confidence), YET AGGRESSIVE EMISSIONS REDUCTION PATHWAYS WILL GREATLY REDUCE THE SEVERITY OF WARMING AND OTHER CLIMATE IMPACT DRIVERS BY 2100 (HIGH CONFIDENCE). IN THE NEAR FUTURE, strong climate change mitigation and air quality measures would lead to notable air quality improvements (high confidence) WITH CRITICAL BENEFITS TO PUBLIC HEALTH AND SOCIETAL CAPACITY TO ADAPT TO CLIMATE CHANGE. Improved understanding of user needs and co-designing of climate information can	Not applicable. Bullet and topic no longer present in the SPM.
17541	43	25			climate service applications' / 'climate services' needs to be made relevant. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Term no longer mentioned in any headline statement of the revised SPM.
97439	43	25			Please define „climate service application“. [Nicole Wilke, Germany]	Noted. Climate service can be found in the glossary.
36303	43	25			Interesting but complex. Too many disparate thoughts for one headline. Minor: 'in focus' seems to hang and not follow. [Michael PRATHER, United States of America]	Accepted. Content of former D5 is now presented much more succinctly and integrated in HS11 and HS14.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44897	43	26	43	26	"Depends on" sounds a bit off. Suggest "takes into account" or "varies with", or suchlike. [Markku Rummukainen, Sweden]	Not applicable. The introduction has been rewritten.
28091	43	28	43	29	There is no sentence in this box on the positive impact of mitigation on other elements than air quality. E.g : replace by "Strong climate change mitigation and air quality measures would lead to notable improvements in air quality as well as reduce the scale of impacts and vulnerability" [Eric Brun, France]	Not Applicable, this section in the final SPM version (D2) now deals with the time necessary to detect the benefits from the measures taken to mitigate climate change and has been separated from the climate information for vulnerability.
130287	43	28	43	29	This sentence seems circular: "...air quality measures would lead to notable air quality improvements". Suggest replacing "air quality measures" with "reductions of air pollutants" or something else. [Trigg Talley, United States of America]	Taken into account, in the final version of the SPM, the effect of measures taken to mitigate climate change are discussed independently from the effect of air pollution policies (D2.2).
108277	43	28	43	29	This sentence is tautological "Strong ...air quality measures would lead to notable air quality improvements". Worse still, since it is only written that these measures improve air quality, the reader interprets that it doesn't have a (positive) impact on climate. I think the sentence should be omitted. [Johannes Quaas, Germany]	Taken into account, in the final version of the SPM, the effect of measures taken to mitigate climate change are discussed independently from the effect of air pollution policies (D2.2).
69447	43	29	43	29	Executive summary in Chapter 6 mentions that "There is high confidence that rapid decarbonization strategies lead to air quality improvements but are not sufficient to achieve, in the near term, air quality guideline values set by the World Health Organization in some highly polluted regions". Based on this sentence, it would be appropriate not to use "notable" here. [Kaoru Magosaki, Japan]	Taken into account, a sentence similar to that suggested by the reviewer has been inserted in the revised version (HS14.2)
108279	43	29	43	31	I don't see a conclusion here, it is a mere hypothesis, and not a meaningful one. This sentence should be omitted. [Johannes Quaas, Germany]	Taken into account the "co-designing" aspect of climate information has been removed from the SPM.
25991	43	30	43	30	It would be more complete if it is stated who will participate in the "co-designing of climate information" [Don Alfonso Pino Maeso, Spain]	Not applicable, the "co-designing" aspect of climate information has been removed from the SPM.
57523	43	30	43	30	I think it should read as "climate services" rather than "climate information"? It is the services that are co-designed with users and not the climate information really. [Chris Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, the "co-designing" aspect of climate information has been removed from the SPM.
17539	43	30			The meaning and significance of 'co-designing of climate information' is unclear. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account the "co-designing" aspect of climate information has been removed from the SPM.
111001	43	30			The meaning and significance of 'co-designing of climate information' is unclear. [Monica Dean, United States of America]	Taken into account the "co-designing" aspect of climate information has been removed from the SPM.
25993	43	35	43	37	There is no confidence statement. [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised version includes confidence statements wherever possible. However, it should be noted that no confidence statement is needed when quantified uncertainties are provided.
86503	43	35	43	37	Please delete this sentence it does not add anything to this section and can confuse the reader who is not familiar with IPCC ember diagrams. [Ala Taimar, Estonia]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
108281	43	35	43	37	The first sentence does not seem to convey a conclusion or even meaning. The statement should start with the second sentence ("Many hazard...") [Johannes Quaas, Germany]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7733	43	35	43	40	The following wording seems to be much clearer (taken from the executive summary of chapter 12): Useful climate information for vulnerability, impacts, adaptation, and climate service applications depends on the regional context and sectoral assets in focus. Regional climate change information for impacts and for risk assessment requires an assessment of the changing profile of tailored climatic impact drivers that link climate conditions to sectors. These climatic impact drivers can take the form of hazards, when they lead to negative impacts, or can lead to beneficial impacts, or both, depending on sector and/or region. [Klaus Radunsky, Austria]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects. Note that climatic impact-drivers are defined in footnote 7.
28093	43	35	43	40	There is a need of an explicit sentence on the direction of the link between hazards and level of global warming. [Eric Brun, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
86607	43	35	43	41	There is very little actual information in this paragraph. [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
54715	43	35	43	49	This is a general concern, but the examples in this text provide an opportunity to make the point concretely. The IPCC calibrated uncertainty language is an essential element of IPCC assessments, but to be effective it must be used appropriately. Over-use tends to weaken its impact and undermine its meaning. In the text referred to here, most of the statements in which calibrated language is used are actually factual statements. For example, "Many hazard characteristics have a direct relation to the level of global warming" is a factual statement (given the word 'many' at the start of the sentence), and so it is hard to understand how and why 'medium confidence' is ascribed to it. The two remaining instances of 'medium confidence' in this sentence are likewise applied to factual statements. Similarly in the next paragraph. We would urge the authors to carefully examine all instances of calibrated language to verify that it is essential (and where it is, traceable). Where appropriate, factual statements can be much clearer and reduce opportunities for misinterpretation. [Nancy Hamzawi, Canada]	Taken into account. The uncertainty language has been carefully checked throughout the revised SPM.
44483	43	35	43	49	These two paragraphs (D.5.1 and D.5.2) partly overlap with A.3.2. In addition, the two paragraphs seem also to contain a similar message but differently packaged. Suggest to merge or reorder content to bring out the messages more clearly. [Jana Sillmann, Norway]	Taken into account. Text streamlined. Note that D5.1 does not really have an equivalent in the revised SPM.
36305	43	35			D.5.1. This is important and reasonable well explained. What I am missing here (and throughout the SPM) is the core fact the CIDs are often socio-economic as the condition (urbanization, poverty, industrialization, ...) will greatly change the climatic impacts of these drivers. This aspect seems to be absent and it is critical in WGII risks, so should be identified in WGI [Michael PRATHER, United States of America]	Noted. The CID concept, as defined in CH12 and footnote 7 of the SPM FGD, is Physical climate system conditions (e.g., means, events, extremes) that can be directly connected with having impacts on human or ecological systems. It is the mandate of WGII to assess the associated risk related to these changes by incorporating socio-economic conditions for example relating to exposure and vulnerability.
66527	43	36	43	36	I would remove "hazard" [robert vautard, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
44899	43	36	43	37	The "and can support... For Concern." could be deleted. It is rather self-evident and in addition does not provide much information just here. [Markku Rummukainen, Sweden]	Taken into account. Bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
17733	43	37	43	37	Consider including a figure or footnote of the IPCC Reasons For Concern. [Anette Jönsson, Sweden]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
19555	43	37	43	37	This D.5.1 paragraph is regrettably poor in information supplied to policy makers. As implied, the "Reasons for Concern" expression belongs indeed to the IPCC lingo. Then it would be fair to include it in the Glossary. [philippe waldteufel, France]	Taken into account. Term removed from revised SPM.
37809	43	37	43	37	Please put a footnote about what 'IPCC Reasons For Concern' specifically means. [Junhee Lee, Republic of Korea]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
54711	43	37	43	40	Consistent with the conclusion of Ch 12 (see Ch. 12 ExSumm (pg 12-9 lines 22-25)), recommend adding "in some cases" before "tipping points cannot be excluded". This is important from a substantive point because it's important to make clear that not all climate system elements exhibit tipping point behaviour. [Nancy Hamzawi, Canada]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
9561	43	38	43	38	Relation> Relationship [Joelle Joelle Gergis, Australia]	Editorial. The report will undergo professional copy-editing prior to publication. This kind of issues will be fixed then.
28095	43	38	43	40	This sentence is unclear because of the repetition of "while". Maybe write instead "And while"? [Eric Brun, France]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
8203	43	39	43	39	Please elaborate on the heavy dependence on time of hazard- caused by what? [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
104299	43	39	43	39	Please elaborate on the heavy dependence on time of hazard- caused by what? [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
111491	43	39	43	39	Change the "while" at the end of the line to "and"? [James Renwick, New Zealand]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
108283	43	39	43	40	It "tipping points cannot be excluded (medium confidence)", what is really meant? Is there medium confidence tipping points will occur? Which ones? Or is it the (meaningless) statement that we hardly ever can completely exclude things? [Johannes Quaas, Germany]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
36307	43	39			change 2nd 'while' to 'and' as the first 'while' carries through. [Michael PRATHER, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
8205	43	40	43	40	Medium confidence that tipping points can not be excluded. Is this the same as medium confidence that tipping points will happen? Otherwise phrase differently. [Frank Dentener, Italy]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
104301	43	40	43	40	"tipping points cannot be excluded (medium confidence)": Please clarify. Can tipping points be excluded at all? It seems that the statement could be made with a much higher confidence. [Philippe Tulkens, Belgium]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
35287	43	40	43	40	See comment 30. You need to expand the range of emissions scenarios in this table. [patrick Michaels, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
111701	43	40			Box SPM.3 contains no information on tipping points. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Noted. But bullet point removed from revised SPM.
36309	43	40			tipping points' as jargon does not help here, why not use 'abrupt' as is used earlier in the SPM. [Michael PRATHER, United States of America]	Not applicable. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
14575	43	43	43	44	Based on SPM C Table 1 Coastal flooding, coastal erosion, MHW and Ocean and lake acidity should also be added to the CIDs stated within parentheses here. [Roshanka Ranasinghe, Netherlands]	Accepted. Coastal flooding and erosion is treated in C.2.5 of the final (approved) SPM.
54713	43	43	43	45	On first read, this sentence is confusing since surface air temperature is shown to stabilize under low emission scenarios (Figure SPM.7) (and so would not continue increasing over the 21st century). Perhaps a solution is to rephrase the text as follows: "...for several climate impact drivers, additional changes in all regions of the world are projected this century, irrespective of the emission scenario." [Nancy Hamzawi, Canada]	Taken into account. This problem has been resolved by linking changes in regional CIDs to warming levels instead of time horizon (HS11) combined with the assessment of different warming levels per time for different scenarios in HS5.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28097	43	43	43	45	This sentence is very ambiguous and might be interpreted as in contradiction with earlier messages such as C1.3 stating that GSAT at the end of the 21st Century strongly depends on the emission scenario. Please clarify the message. [Eric Brun, France]	Taken into account. This problem has been resolved by linking changes in regional CIDs to warming levels instead of time horizon (HS11) combined with the assessment of different warming levels per time for different scenarios in HS5.
86609	43	43	43	49	Very little information here. Essentially saying "Things will continue to change" ! [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Regional specificities have been explained in the SPM (see section C2 of final (approved) SPM.)
104303	43	43	43	49	Information about the projections beyond 21st century should be provided in paragraph D.5.2. [Philippe Tulkens, Belgium]	Taken into account. The final (approved) SPM give information on global warming levels and state that "Changes in several climatic impact-drivers would be more widespread at 2°C compared to 1.5°C global warming and even more widespread and/or pronounced for higher warming levels."
12685	43	43	43	49	Up to now, I'm still not clear about the definitaion of "climate impact factors", what physical parameters are "climate impact factors" and what are not?? Maybe worthy to include a list in chapter-1 or glossory? [Lijing Cheng, China]	Accepted. Definition is in footnote 36 of the final (approved) SPM.
66529	43	43	43	49	The relation to sectors should be improved in this paragraph, otherwise it could duplicate statements of Sections C [robert vautard, France]	Accepted. The revised SPM has been carefully checked not to include any overlaps.
130289	43	43	43	49	Recommend removing D.5.2. This has already been covered. [Trigg Talley, United States of America]	Accepted. The revised SPM has been carefully checked not to include any overlaps.
36311	43	43			This is all true, but has been said before. What I am missing here is how this applies to 'climate information' and how it depends on users. [Michael PRATHER, United States of America]	Not applicable. The SPM does no longer include the "users".
97441	43	45			This statement is misleading: Please clarify that the degree of change is not "irrespective of the emission scenario". [Nicole Wilke, Germany]	Taken into account. This problem has been resolved by linking changes in regional CIDs to warming levels instead of time horizon (HS11) combined with the assessment of different warming levels per time for different scenarios in HS5.
97443	43	46			How would changes remain, and could they also be amplified? [Nicole Wilke, Germany]	Taken into account. Changes in CIDs are now given by GWL rather than by time, which resolves the first issue. See C.1.2 on amplification and attenuation due to internal variability in the final (approved) SPM..
50439	43	47	43	47	Suggested edit: different extreme events, defined in this context as 'hazards' (such as ...' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The sentence has been deleted.
9563	43	47	43	49	Phrasing needs work. Suggest using the concept of extremes occuring on the background of warmer mean state temperatures [Joelle Joelle Gergis, Australia]	Not applicable. The sentence has been deleted.
25999	43	47	43	49	It would be interesting to add information on other compound events as described in chapter 11, page 9, lines 34-38: "There is medium confidence that the likelihood of compound flooding (storm surge, extreme rainfall and/or river flow) has increased in some locations, and will continue to increase due to both sea level rise and increases in heavy precipitation. There is medium confidence that wildfire (compound hot and dry event) risk has increased in some regions over the last century. There is medium confidence that various risks of other compound events will increase under higher levels of global warming". [Don Alfonso Pino Maeso, Spain]	Noted. Some detail added in HS11.5.
35289	43	49	43	49	See last comment. [patrick Michaels, United States of America]	Noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
116135	43		43		D4.2, could there be a more quantitative statement here (which amount of emission reductions for instance expressed through a mean rate of decrease over a certain number of years) would be detectable? [Valerie Masson-Delmotte, France]	Taken into account HS14.3 (was D4.1) now includes scenario information.
50441	44	1	44	1	The term 'precursor' may not be clear to a policymaker - it would be helpful to state what it's a precursor to and why that is relevant. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, this term is clarified thanks to the visual of figure SPM2 in the final version.
25997	44	1	44	2	It would be useful to include a definition of "precursor emissions". [Don Alfonso Pino Maeso, Spain]	Taken into account, this term is clarified thanks to the visual of figure SPM2 in the final version.
17735	44	1	44	8	The relation/interaction between air quality improvements and climate change mitigation is not clear. Do policymakers need to choose between air quality improvements or climate change mitigation? [Anette Jönsson, Sweden]	The air quality control policies and climate change mitigation are decided at different levels and most of the time not coordinated. Chapter 6 assesses the effect of each and highlights how they can complement each other. This is reported in the last sentence of D2.2 in the final SPM.
20355	44	1	44	8	The WG1 report should of course not ignore air quality issues. It should first determine the impact of global change on it, depending on scenarios; it should next discuss whether mitigation actions tend to improve air quality or the other way around. Unfortunately, this D.5.3 paragraph gives the feeling that it dodges deliberately both issues. This may not be the best way for IPCC to inspire confidence to policy makers, nor to be useful to them [philippe waldteufel, France]	The IPCC assesses the existing literature. The SSP scenario as they have been used in the AERChemIP modelling exercise do not allow to separate the effect of emission and climate change on air pollution except for SSP3-7.0. The final version of the SPM focuses only on the effect of emissions changes which are the dominant drivers of future trajectories for SLCFs.
97445	44	1	44	8	It seems obvious that AQ measures will lead to reduced pollution, please reconsider. [Nicole Wilke, Germany]	Taken into account, in the final version of the SPM, the effect of measures taken to mitigate climate change are discussed independently from the effect of air pollution policies (D2.2).
77105	44	1	44	9	Some reference to UNECE CLRTAP is warranted as well as its work on ecosystem impacts which links back to Art 2 of UNFCCC which also mentions ecosystems. This would highlight synergies and complementarities [Emer Griffin, Ireland]	Rejected, impacts on ecosystem and biodiversity is beyond the mandate of WG1.
36313	44	1			Good to see the air quality here, but similar to above: how does this apply to sectors and users. Can this section be framed better? [Michael PRATHER, United States of America]	Rejected, the discussion of sectors is not appropriate in WG1 SPM, the assessment of the effect via sectoral emission is provided in the TS but not reported in the final SPM.
111703	44	2	44	5	This is fine, but is it also important to consider scenarios of strong AQ but weak climate mitigation (i.e. decreasing aerosol but increasing GHG), or weak AQ but strong climate mitigation? [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in the chapter 6 in which the effect of such scenario have been assessed but, as this is not based on the five illustrative scenarios at the heart of the WG1 assessment, this is not reported in the final SPM.
50445	44	2	44	8	It would be useful to specify here that maximum co-benefits can be achieved by considering air quality and climate change actions together rather than tackling them as separate issues. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The air quality control policies and climate change mitigation are decided at different levels and most of the time not coordinated. Chapter 6 assesses the effect of each and highlights how they can complement each other. This is reported in the last sentence of D2.2 in the final SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
69449	44	4	44	5	If "weak climate and air pollution mitigation" would lead to strong increases in the air pollutants, it would seem inappropriate to be called "air pollution mitigation" (even with the word "weak"). This sentence seems to be confusing and it would be requested that rephrasing would be considered. [Kaoru Magosaki, Japan]	Rejected, high GHG emissions scenarios see an increase in fossil fuel burning in the future. Thus it leads to increase in co-emitted air pollutants which are not sufficiently abated by weak air pollution mitigation. A mitigation is related to efforts done on emissions not to their success.
108285	44	4	44	5	If there is mitigation (even if weak) and if climate doesn't matter for pollutant emissions (one sentence earlier, high confidence), where would the strong concentration increases come from!? [Johannes Quaas, Germany]	Rejected, high GHG emissions scenarios see an increase in fossil fuel burning in the future. Thus it leads to increase in co-emitted air pollutants which are not abated by weak air pollution mitigation. It consequently induces an increase of their concentrations. Climate change is not the main driver of global air pollution trajectories but climate change mitigation through its modification of emissions (resulting from changes in sectoral activities) affect air pollutants through their emissions.
50447	44	5	44	8	This sentence suggests that any decarbonisation activity would improve air quality, however this is not always the case, for example biomass would cause air quality issues. Perhaps adding "can" would help to indicate the nuance. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Large scale biomass energy development, as considered in scenario, are accompanied with carbon capture and storage. Here "decarbonisation" embeds a large set of measures as envisaged in scenario compatible with the Paris agreement goal.
50443	44	6	44	6	will lead to 'air quality improvements' but also a short term positive influence on radiative forcing. Suggest it is important to highlight this here too. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected, the effect of SLCF change on climate is treated separately (for sake of clarity) in the statement D1.7 of the final SPM.
28099	44	6	44	8	Box 6.2 also indicates that reductions in SLCF provide opportunities to attain some of the SDGs. [Eric Brun, France]	Taken into account, the SDGs are mentioned in HS14.2.
9565	44	7	44	8	Provide specific examples of highly polluted regions. [Joelle Joelle Gergis, Australia]	Rejected, SPM of WG1 is focussed on climate and detailing the highly polluted regions would dilute the message here which is about the time when discernible effects after strong mitigation will be discernible.
82547	44	10	44	10	This could reasonably be a statement of fact without requiring likelihood language. [Blair Trewin, Australia]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
89835	44	10	44	10	Please delete "It is virtually certain that" - the statement that follows is a fact. [Rowan Sutton, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
106063	44	10	44	11	I think it is also very important to recognize the value systems that people bring to this understanding, I suggest following this sentence with one given earlier, on p. 7, lines 38-39: "There is high confidence that climate change messages are influenced by the values of those constructing, communicating and receiving the message." [William Gutowski, United States of America]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections.
17543	44	10	44	11	First sentence of this para. It is not clear what value this first sentence adds to the SPM. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
108287	44	10	44	15	Again, we rather should prove that what we write is useful, rather than pretending it is. In such sentences, I find likelihood statements rather bizarre (but in fact, the entire statements useless). [Johannes Quaas, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8207	44	10	44	22	Seems to fit better under section A.3 [Frank Dentener, Italy]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections.
81963	44	10	44	22	Helpful paragraph, please retain. [Dan Zwartz, New Zealand]	Noted.
86611	44	10	44	22	Very information here. This is not the kind of strong statement I would expect in an IPCC WG1 SPM... [Pierre Friedlingstein, United Kingdom (of Great Britain and Northern Ireland)]	noted.
104305	44	10	44	22	Seems to fit better under section A.3 [Philippe Tulkens, Belgium]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections.
109709	44	10	44	22	Broad-based community and democratic involvement seem to be noticeably absent from this vision statement, which focuses without any introspection on the existing technocratic, top-down philosophy of climate change policy formation and governance that has undoubtedly contributed in part to some of the public distrust we've unfortunately seen in several countries around climate change mitigation efforts. I suggest taking this opportunity to propose a somewhat more egalitarian and democratic tone to climate change policy formation. [Sean Fleming, United States of America]	Not applicable. In the revised SPM, section A has been removed and the important information it contained has been incorporated in the other sections.
111249	44	10	44	22	The bullet D5.4 is the last in SPM and very important on communicating climate change information. It is worth to split it in two with one fully on climate services and their role [Volodymyr Osadchy, Ukraine]	Not applicable. Bullet point has been removed from the revised SPM due to shortening constraints.
87201	44	10	44	22	This is an important well-written and useful point, especially for policy-makers. Please retain. [Oyvind Christophersen, Norway]	Not applicable. Bullet point has been removed from the revised SPM due to shortening constraints.
34559	44	10	44	22	This is good and also a bit generic. The message would be stronger if there was an evidence base you could point to measuring the increased use of climate change information in actual decisions at the regional scale, or at least some broad statement about what regions, nations, or sectors that are making headway in this regard. [Russell Vose, United States of America]	Taken into account. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36315	44	10			complex' is not needed, since simple climate info is understood differently also. Don't make it sound like mystical science, too complex for anyone to understand. [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36317	44	10			D.5.4. "climate services" is an important term and quite well known. It would be good to introduce this much earlier in the SPM, possibly in preamble material. I think this is the first use of that term. [Michael PRATHER, United States of America]	Taken into account. 'Climate service' introduced in the introduction of the 3rd section on 'Climate Information for Risk Assessment 1 and Regional Adaptation'
44901	44	11	44	15	This could be deleted, as it does not seem to say anything of any outcome. To merely say that there has been progress adds words without evident information. [Markku Rummukainen, Sweden]	Taken into account. Bullet point removed to shorten the SPM and focus on the most policy-relevant aspects.
111493	44	13	44	13	Change "...appreciation of climate scientists to involve..." to "appreciation by climate scientists of the value of involving..." [James Renwick, New Zealand]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
38985	44	13	44	14	From a communications specialist perspective, may I suggest to rephrase this as "...and an involvement of scientists from a variety of disciplines as well as communication specialists and practitioners to support the co-design and co-development process that is fundamental to a successful climate service." It is not so much about the "appreciation", but about the involvement itself, plus social scientists can focus on climate as well and practitioners will be able to contribute a wealth of knowledge and expertise that might not be available to purely academic researchers. You could also simply say "...and an involvement of specialists from a variety of areas, including practitioners..." [Maike Nicolai, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
97447	44	13	44	14	The understanding of climate science does seem to exclude social sciences including economy, which does not seem appropriate in the context of the IPCC. Climate science is multidisciplinary reaching from natural sciences, social sciences and the humanities. Please be more specific and avoid ambiguities, including when considering the translation of this text. [Nicole Wilke, Germany]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
57525	44	16	44	17	it could be misleading to describe climate services as being developed just for timescales from sub-seasonal to multi-decadal. While the text may not mean to imply that services are mostly based on climate predictions and projections of the future, it could be misinterpreted. Many climate services are providing information about past and current climate, and not the future climate at all. How about "timescales (from historical climate information to future climate on sub-seasonal to multi-decadal) and target users (high confidence)"? [Chris Hewitt, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
28101	44	16	44	17	Applying a high confidence level to the timescales targetted by climate services seems overly optimistic! Most available climate services target end of the century time horizons. It is true that shorter time horizons need to be addressed but I think this is not done yet, at least not for many sectors such as agriculture. So I would be more humble with respect to the confidence level. [Eric Brun, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
53529	44	19	44	21	May be add that: Poorly sampled or poorly understood climate information may lead to overconfident and unsuitable adaptation strategies. [Hervé Douville, France]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
36319	44	19			Yes, of course, but you miss the opportunity to point out that IPCC was designed to be a dialogue between science and governments at the ministerial level, and it has succeeded. IPCC currently does provide the climate services that national governments are using! Please do not act like this is something new. [Michael PRATHER, United States of America]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
9761	45	0	45	0	this non-specialist is wondering why the increase in paleo-climate waming is much less than the increase in GMST when it's begn going on longer [Jonathan Lynn, Switzerland]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
104307	45	0	45	0	Figure SPM.1: The label for the blue line ("Arctic sea ice melting") should be replaced with "Arctic sea ice extent", given the declining trend and the units. [Philippe Tulkens, Belgium]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note that the time series in Fig SPM.8 now says 'sea ice area'.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86151	45	0	45	0	Figure SPM.1. Given the increased emphasis on GSAT in the WGI report why does this figure not use GMST and the GSAT equivalents to help policy makers understand the relationship between the two? [Debra Roberts and the Durban WGII TSU, South Africa]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
15051	45	0	48	0	Figures SPM-1,2,3 and 4 are probably the only one that are essential for the Summary, illustrating the most important results with some basic description. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Noted. (but note that the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.)
130453	45	0	57	36	It is better to delete Figure SPM.2, and redesign SPM.8. I do not think many variables/indicies over ocean are reasonable in SPM 8. [Panmao Zhai, China]	Taken into account. Figures SPM1 and SPM.2 have been removed from the revised SPM. Figure SPM.7 (now Fig SPM.8) and SPM.8 (now fig SPM.5) have been completely redesigned.
131845	45	0			figure SPM1 Title: emerging or emerged? Emergence is a defined term in the SPM so suggest to indicate where the variables have emerged eg thicker lines [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
131847	45	0			figure SPM1 Could some of the variables be grouped into panels (see SROCC SPM1) - where they are on the same axis eg GMST, paleo GMST, troposphere warming [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
131849	45	0			figure SPM1 Palaeo GMST will need explaining and why in the last century this is so different from GMST [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131851	45	0			figure SPM1 Box SPM1.1 says that GSAT is the primary climate metric for WGI yet this metric is not shown here [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
97449	45	0			Please consider providing information about snow cover, glaciers, or other phenomena related to large scale atmospheric or ocean circulation or modes of variability pattern shown in section B, e.g. the Earth energy imbalance. [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97451	45	0			Please explain "tropospheric warming" for laypersons, how is it linked to "air temperature" shown in figure SPM.2? [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97453	45	0			The left figure for the last 2000 years fails to convey the message that the current change is exceptional. The cherry blossom date does not seem to have changed much? We suggest to rather use the upper part of Figure TS.12. [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97455	45	0			We appreciate the indication of key moments in history of climate science. [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97457	45	0			What does "Paleo-GMST warming + 0.65°C over 1850-2000" mean? Is the larger the warming until 2018 of 0.36 °C only caused by the additional anthropogenic warming in these 18 years? [Nicole Wilke, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
80393	45	1	45	1	Horizontal axes should state they correspond to years in the CE [Paola Arias, Colombia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
8209	45	1	45	1	Most variables in this figure are from more-or-less direct observations. Is this also true for ocean heat content? [Frank Dentener, Italy]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50449	45	1	45	1	Figure SPM1: given the SPM refers to GSAT throughout rather than GMST, I would suggest that temperatures in this figure should be given in GSAT, not GMST for consistency. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
50451	45	1	45	1	It is difficult to discern an obvious trend in the cherry blossom data in Figure SPM1, especially due to the large variability. As this is not a key indicator relevant across the world with obvious wider climate system/climate impact implications, I suggest this dataset could be removed. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
50453	45	1	45	1	Figure SPM1: it would be easier to interpret this figure if all the y axes were on one consistent side of the diagram, instead of alternating. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note that the only time series in the revised SPM (fig SPM.8) does show all the y axis on the left hand side (except panel e, which is an extension of panel d)</p>
50455	45	1	45	1	Figure SPM1: zetajoules are not a well understood metric for most policymakers - would it be possible to replace this with ocean temperature instead, or qualify zJ=temperature? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note that the ocean heat content is no longer shown in any figure of the revised SPM.</p>
17737	45	1	45	1	Consider changing "Sea level rising" to "Global mean sea level rising" [Anette Jönsson, Sweden]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note that the only time series in the revised SPM (fig SPM.8) says 'global mean sea level change'</p>
79947	45	1	45	1	Figure SPM.1. The intent of this figure is clear. However, due to the sheer number of trendlines shown the figure is quite dense. The positioning of y-axes is also problematic for the reader, as is the lack of any x-axis lines when interpreting the upper trendlines (CO2, Ocean Warming and Sea level rise). Suggest the authors consider simplification of this figure - by reducing the number of trendlines presented (link to Figure SPM.2 -display the same set of trends?) and reordering the layout in terms of y-axis positioning. [Eamon Haughey, Ireland]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
17739	45	1	45	1	Consider a footnote or similar for HadCRUT5, PAGES2k and RSS. [Anette Jönsson, Sweden]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17741	45	1	45	1	Why GMST instead of GSAT? [Anette Jönsson, Sweden]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
104309	45	1	45	1	Most variables in this figure are from more-or-less direct observations. Is this also true for ocean heat content? [Philippe Tulkens, Belgium]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97459	45	1	45	1	Figure SPM.1: The caption should explain the many abbreviations that are not known to non-experts. Please indicate the period over which these observations are averaged. In addition, please provide the "AR5-temperature". Maybe the text can be written outside the figure since it is very populated in its current form. [Nicole Wilke, Germany]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that in the revised SPM, the only figure with time series (fig SPM.8) now shows one variable per panel.</p> <p>Additionally, in the revised SPM we have significantly reduced the use of acronyms.</p>
54721	45	1	45	1	This is clear and compelling figure. The only concern is with the duplication of GMST time series in the main panel -- one from direct observations, and the other 'paleo'. SPM figures should ideally be self-explanatory, and readily understood by policy-makers. Having two different measures of GMST, whose difference will not be universally understood, is more likely to create confusion than clarity. It would be fine to retain the paleo GMST estimate in the left panel (providing longer time-scale perspective), but the duplication from 1850 to near present (but not quite) is unnecessary and probably undesirable. [Nancy Hamzawi, Canada]	Taken into account. Fig SPM.1a of the revised SPM shows both paleo and observed temperature with the same y-axis (they are therefore overlain).
54723	45	1	45	1	'Warming' should be consistently applied to a climate system component (e.g. atmosphere or ocean), not to a quantitative measure like GMST (which is appropriately labelled as 'increasing'). Similarly the Arctic sea-ice measure that is shown represents area change, not mass or volume change, and so would be better labelled as 'decline' rather than 'melting'. [Nancy Hamzawi, Canada]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note that fig SPM.8 (now the only time series of the revised SPM) only refer to 'change' for relative variables (see panels a and d)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
4565	45	1	45	1	Fig. SPM-1. The illustrated new “hockey stick” by PAGES2k 2019 is highly questionable and should not be used. The database is controversial and contains numerous flaws and gaps. Notably, the database in the southern hemisphere is rather weak and contains various questionable proxy series (see Lüning et al. 2017: chapter 4.7; Lüning et al. 2019: chapter 5.7). Large parts of the continent interiors of Africa, Australia and South America (outside the Andes) are not covered by palaeotemperature data, hence represent palaeotemperature “white space”. The IPCC climate status report is the right place to acknowledge these major data gaps and stimulate additional research on the palaeoclimate of the past millennia in these regions. Details can be found in the following papers. It is important to mention this side of the debate: Lüning et al. (2019): The Medieval Climate Anomaly in South America. Quaternary International, 508: 70-87. doi: 10.1016/j.quaint.2018.10.041; Lüning et al. (2017): Warming and cooling: The Medieval Climate Anomaly in Africa and Arabia. Paleoclimatology and Paleoclimatology, 34 (10): 1625-1649, doi: 10.1029/2019PA003734, The Medieval Climate Anomaly in Oceania. Environmental Reviews, doi: 10.1139/er-2019-0012, Lüning, S., M. Galka, F. Vahrenholt (2019): The Medieval Climate Anomaly in Antarctica. Palaeogeogr., Palaeoclimatol., Palaeoecol., 532, doi: 10.1016/j.palaeo.2019.109251. [Sebastian Luening, Switzerland]	Rejected / taken into account. The PAGES global temperature reconstruction is based on the most comprehensive, quality controlled, publicly accessible proxy dataset available to date. Estimated uncertainties are based on an ensemble of multiple reconstruction methods that take into account a variety of sources of error. While filling in data gaps would reduce uncertainties, estimates can nonetheless be made using the available data. The purpose of figure SPM.1 is to illustrate changes in global surface temperature, including over the oceans, rather than regional or continental-scale temperature. Articles authored by the commenter are valuable additions to understanding inter-regional similarities and differences and are cited in Chapter 2.
39659	45	1	45	1	If space allows would it be possible to group the atmospheric and the ocean variables together (i.e., ordering: CO2, GMST, Paleo-GMST, Tropospheric, cherry blossoms, Ocean warming Sea level rise, Arctic sea ice? [TSU WGI, France]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
87277	45	1	45	1	Fig SPM.1: The Kyoto cherry blossom date is a very local indicator. We advise to skip. [Marcel Berk, Netherlands]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
10223	45	1	45	1	GMSL can be extended back to year 0 based on Kemp et al 2018. [Robert Kopp, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
87279	45	1	45	1	Fig SPM.1: temperature evolution using Hadcrut and Pages2K are given in GMST in stead of GSAT, which is the new global temperature indicator used in AR6. Convert or add some explanatory text [Marcel Berk, Netherlands]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
10225	45	1	45	1	Unclear how the difference in paleo-GMST warming and GMST increasing is supposed to be interpreted [Robert Kopp, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
76785	45	1	45	1	Figure SPM.1: This is going to be a very illustrative figure. A few suggestions: the balance between the left and right panels might not be ideal yet, or maybe there needs to be some shading in the left panel to show what proportion of time is in the right panel. The concept of emergence isn't clearly illustrated yet. Palaeo SL could be added. Ocean acidification (and also deoxygenation) are key changes that should also be shown. What level of the ocean is the OHC data used for (and is this partly modelled - I didn't think that there were reliable observational datasets for this prior to the 1950s? Could the observed and palaeo GMST datasets be overlaid to emphasise the agreement between data sources. Same for CO2 - show observed and ice core measured on the same subplot but with different shades. The additional key historical accounts is really useful. I'd suggest also adding 1990: First report of the IPCC. [Nerilie Abram, Australia]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that in the revised SPM : 1) fig SPM.1 - which shows both paleo and observed temperature - uses some shading to highlight the links between panels a and b and uses only one axis for both curves, which are therefore overlaid. 2) ocean acidification is shown in the only time series (fig SPM.8)
130291	45	1	45	1	[PRECISION] x-axis needs a label, (e.g., "year"). A geologist could interpret the "0" as modern or zero years before present. Obviously this is not the case. [Trigg Talley, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
87207	45	1	45	2	Figure SPM 1: The graphs in the figure are somewhat horizontal due to very compact y-axis's. Perhaps all the parameters showing temperature increase could be combined to give more space, or simply just expand the vertical size of the figure, by presenting this figure in landscape format. This figure has a simple and clear frame for temporal evolution of climate parameters. Perhaps it can be a framework for the other temporal figures in the SPM to make them more familiar and easier to read. We would recommend that you change the vertical order of the parameters so that you would get a better separation between very noisy lines that doesn't necessarily correspond with each other (e.g Co2, GMST, Paleo-GMST, Ocean, sea ice, Sea level, Cherry and troposphere. We also wouldn't mind if you combined Paleo-GMST for the last 2000 years and GMST for 1850-until today to present less lines in the figure. Please also consider if tropospheric warming is really necessary for the message you want the reader to absorb. [Oyvind Christophersen, Norway]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that in the revised SPM, the only figure with time series (fig SPM.8) now shows one variable per panel.
87019	45	1	45	2	Figure SPM.1: It is very interesting and illustrative to see both the last 2000 years perspective and the 1850-today perspective with important historical events indicated on the time axes. However, it may be confusing to present them next to each other since this gives the impression that the timeline is continuous, instead of there being two graphs. In addition, the 1850-today graph is so stretched out that it takes a trained eye to notice the trends, and the short y-axes are a challenge to read. [Oyvind Christophersen, Norway]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
130295	45	1	45	40	It would help to have a few thin horizontal lines at selected thresholds for each timeseries to guide the eye. [Trigg Talley, United States of America]	Taken into account. Figure SPM.8, which is the only revised figure showing time series, includes horizontal lines.
109317	45	1	45	50	SPM.1: Great figure! The one item that seems problematic is Paleo-GMST, since its magnitude seems to conflict with instrumental GMST charted just above it. For an SPM, the meaning of this line on the chart should be further clarified in the caption for both last 2K years (add a phrase about what is PAGES2K) and for 1850-2000 (why this is a useful measure, and why its magnitude is just over half of the GMST from instruments.) [Paul Edwards, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
130293	45	1	45	50	The paleo GMST figure should have its ordinate extend below zero to give an estimate of the cooling shown in the figure. [Trigg Talley, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131853	45	1	46	1	Check value for GMSL for consistency - 18 or 19 cm rise? - see value in caption and in the graphics SPM.1 and SMP.2 [Hans Poertner and WGII TSU, Germany]	Not applicable. The figures have been completely revised and observed sea level rise is no longer shown. However we have made sure that the numbers given in the text are consistent with the rest of the report.
76787	45	1	46	1	Figures SPM1 and 2: I understand the value of adding a historical dataset to these figures, but I wonder if highlighting the cherry blossom dates detracts more from the message than wah tis adds (it's a change that doesn't have any major consequence so could generate a message of "who cares" about the figures) [Nerilie Abram, Australia]	Taken into account t. Cherry blossom no longer appears in any of the revised figures.
40337	45	1	57	2	Giving the purpose of the visual elements was quite helpful. Also having titles to these visual elements (i.e., SPM.1 and SPM.10) was also very helpful. Perhaps this giving of titles could be generalized. [TSU WGI, France]	Accepted. All figures now display an intent.
87203	45	1	57	12	General comment graphics: We believe that the figures provided in the draft form a good basis for further development. We appreciate the paras that are written under some of the figures which describes the intent. We encourage the authors to develop such paras for all figures and place such texts right below the title and before the figure itself. Also, try to stick with the formulated intention. Please also bear in mind that when it comes to graphics that are intended for policymakers, less is more. Generally, we still feel that many of the figures are to complex, and therefore are not helping policymakers to understand the messages/intentions you want to convene. In its current form we believe that they work better for the Technical Summary than Summary for policymakers. Especially since they in the current form are more of an analytically supporting approach, compared to tools that are meant to synthesise policyrelevant findings. [Oyvind Christophersen, Norway]	Accepted. 1. All figures now display an intent. 2. the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
87205	45	1	57	12	General comment graphics: We encourage you to try to think if there are ways to furter simplify the figures so that they also can be used directly in presentations given to policymakers. Figure.SPM.2 is a good example of something that can be used in presentations, please consider to include something similar for the different SSPs at different future time periods (e.g. 2030, 2040-2060 and 2080-2100). Here you could also change the background scematics e.g more/less snowcover, more/less arid areas, more/less forest degradation etc. We encourage you to try to graphically visualize how the different scenarios would influence the future world. [Oyvind Christophersen, Norway]	Accepted. the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
78593	45	1			figures 1 and 2 are both nice but cover similar ground. I think figure 1 is more technical and would suit the TS. Figure 2 is a nicer way for simply conveying information in an SPM. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 and SPM.2 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
109215	45	1			Figure SPM.1 -- overall good graphic, I think the paleo GMST/GMST combo in the instrument era may be confusing, specifically because they show significantly different warming. I think this is due to the differing end point of the time series, but nonetheless is confusing for someone just trying to get the big picture out of this graphic. Consider showing only regular GMST in the instrumental era and only paleo in the paleo time series. Troposphere data kindof has the same problem (irregular messaging about the amount of warming) but that could be resolved with more information in the caption perhaps (specifically saying warming from ~1970-2018, or whatever the time period is). [Steph Courtney, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
131855	45		45		Figure SPM.1. Explanation needed for the term "instrumental" period. [Hans Poertner and WGII TSU, Germany]	Taken into account. Term no longer appears in the revised SPM.
7735	45		45		Caption to figure SPM.1: It is suggested to reword the following two sentences: The intent of this figure is to highlight that multiple climate indicators show that changes are emerging across the climate system, from the atmosphere to the ocean to the cryosphere and biosphere. This emergence is seen over the instrumental record (1850-2018) and over the last 2000 years. Suggested rewording: This figure highlights that multiple climate indicators show changes across the climate system, from the atmosphere to the ocean to the cryosphere and biosphere. Some of these changes are shown not only over the instrumental record (1850-2018) but also over the last 2000 years. [Klaus Radunsky, Austria]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
7737	45		45		It is noted thzat the figure caption offers two numbers for the temperature increase since the preindustrial period: The GMST increased by 1.1oC over 1850-2018 while the warming estimated from paleo GMST is equal to 0.65oC over 1850-2000. In order to avoid any misinterpretation some further explanation should be provided - e.g. one on the difference in the time period covered, and another on the associated uncertainties. It would of course also be helpful to explain the rationale for this comparison - because it helps to demonstrate the usefulness of looking a longer time period in the past than would be possible without those paleo data. [Klaus Radunsky, Austria]	Taken into account. Figure SPM.1 of the revised SPM shows both the observed and paleo global surface temperature change. However, it does not give any values. As a result the only value provided in the SPM is the observed warming presented in HS1.2
50521	45		45		Figure SPM.1 is very useful and clear. It is informative to see all this indicators of change presented on the same timescale. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
50523	45		45		Figure SPM.1 caption includes "identification of primary greenhouse gases by John Tyndall in 1861", but in 1856 Eunice Foote demonstrated the absorption of heat from solar radiation by carbon dioxide and water vapour also posited a direct connection to their variability as a possible cause of climate change (Jackson, 2019. Eunice Foote, John Tyndall and a question of priority. Notes Rec.74105–118 http://doi.org/10.1098/rsnr.2018.0066 https://royalsocietypublishing.org/doi/10.1098/rsnr.2018.0066). Although Foote's conclusions were not as sound Tyndall's, she was the first to make a scientifically-based suggestion that carbon dioxide affects climate and hence her contribution should also be mentioned here. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.
9567	45		45		I think this figure would work best as two separate panels. The last 2K plots are too small to be maningful. Could have last 2k on the top then lines to indicate a zoom in to the industrial period plotted underneath. While interesting, I'm not sure how useful the cherry blossom dates are in this figure. Perhaps clearly mention that warming is influencing plant behaviour/phenology? [Joelle Joelle Gergis, Australia]	Taken into account. Figure SPM.1 of the revised SPM shows both the observed and paleo global surface temperature change with both curves overlaid/using the same y-axis. It also uses some shading to link panel a (long-term) and panel b (recent past). Additionally, the former figure SPM.1 has been removed from the revised SPM, to shorten the document.
104311	45		45		The very flat presentation of the curves in Figure SPM-1 is very unfortunate as it masks the large increases associated with the anthropogenic influence on climate change. A gallery-style presentation with a graph per curve would be much more appropriate. [Philippe Tulkens, Belgium]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that in the revised SPM, the only figure with time series (fig SPM.8) now shows one variable per panel.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111005	45		45		The SPM Figure 1 description on key moments in climate science is overlooking the contribution of Eunice Footnote. [Monica Dean, United States of America]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.
90797	45		45		FIGURE SPM.1: Delete the text in italics as it has to be included in the caption. [José Romero, Switzerland]	Rejected. The intents of the figures have been sharpened, shortened and integrated on the figures themselves.
108207	45		45		SPM.1 An excellent figure. Would be a good candidate to be presented as an interactive data visualization. [Anton Holland, Canada]	Noted.
26035	45		45		FIGURE SPM.1. Please, make a wider separation between left (last 2000 years) and right (instrumental) graphs. Also and some coloured vertical band in the left part to indicate the expanded instrumental period. [Don Alfonso Pino Maeso, Spain]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
54719	45		45		Figure SPM.1: In general, we strongly support including a Figure that conveys the message that current changes in climate are unprecedented across many indicators. Specific suggestions for improvement are: 1. first dotted line - since this isn't a climate science discovery in any case, it might be more helpful to have a line denoting the year 1850 in the LH graph (so we can match this to the start of the RH graph), (Generally, OK to delete all the dotted lines since they are a bit of a distraction from the main message of this Figure), 2. Be more specific about what the last timeseries in the graph represents - summer (seasonal avg) arctic sea ice decline, September Arctic sea ice decline? [Nancy Hamzawi, Canada]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. However the 2 points have been taken into account in the revised figures. 1. Fig SPM.1 of the revised SPM, uses shading some shading to link panel a (long-term temperature changes) and panel b (recent past changes). 2. Figure SPM.8, the only time series of the revised SPM does not include dotted vertical lines anymore.
110811	45		45		Great plot (except for cherry blossom which I find a bit anecdotal) [cathy clerbaux, France]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
46563	45		45		Why is "earlier blossom" associated with positive days, rather than with negative days? [Dirk Notz, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
114919	45		45		Figure SPM-1: Great figure. Why is GMST shown instead of GSAT? GSAT is the principal surface temp metric in the report according to Box SPM-1. [Elmar Kriegler, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
18703	45		46		Excellent figures for effective communication via the SPM. Congratulations to the drafting team of authors! [Govindasamy Bala, India]	Noted with thanks.
15455	45		46		Figure SPM.1 shows Arctic September sea ice extent decreasing at -35% since 1979 (see Figure caption) while Figure SPM.2 shows summer sea ice area decreasing at -35%. Sea ice area and sea ice extent are two different measures (Ref.: http://nsidc.org/arcticseaicenews/faq/#area_extent). Please consider harmonizing the terms used. [SAI MING LEE, China]	Not applicable, Fig SPM.2 does not exist anymore in the revised SPM.
104313	45		46		The representativeness and the appropriateness of using Kyoto cherry blossom date as a climate indicator should be reconsidered. Using a variable associated to vegetation is relevant, but a variable more pertinent worldwide would be preferable. [Philippe Tulkens, Belgium]	Taken into account t. Cherry blossom no longer appears in any of the revised figures.
17545	45		46		If this report is too long, perhaps the information on Figures SPM.1 and .2 could be merged? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM.
111003	45		46		SPM Figures 1 and 2 seem to display the same information. Perhaps SPM Fig2 is better suited for use in the FAQs? [Monica Dean, United States of America]	Accepted. Figure 2 no longer features in the revised SPM.
17547	45		49		References to HadCRUTv5 need to be explained. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The text does not mention the term anymore.
17561	45		57		While the figures are informative and really add value, graphically reinforcing key points, their reproduction at smaller scale might make them almost impossible to read. Can the two world maps go landscape, not portrait? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. All figures have been revised/produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible. However, all of them are still in portrait.
17563	45		57		All figures, but particularly figure 3. Does the colour palette used make it accessible to people who are colour blind? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. All figures have been revised/produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
132413	45				Figure SPM.1: I would suggest to add an indicator of changes in climate over land, e.g. the evolution of the temperature of the hottest days of the years averaged on land, which displays a substantially larger increase than the mean global temperature, and also a different behaviour during the so-called "hiatus" period (continued strong warming; e.g. Seneviratne, Donat, Mueller, Alexander, 2014, Nature Climate Change). This could be displayed on top of "troposphere warming". [Sonia Seneviratne, Switzerland]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
112701	45				I would add the glaciers to that figure. I like the idea of the figure and it will be nice when beautified [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42341	45				Box 1 highlight GSAT will be used as principal surface metric throughout the report but figure SPM.1 uses GMST. What is the correlation? [Tina Christensen, Denmark]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
1901	45				Why are you using GMST in this figure when Cross-chapter box 2.3 says that there is a decision to "use GSAT as the primary metric of surface temperature changes in this report?" I think this will only confuse the issue if you mix GMST and GSAT, and FAQ 1.4 only talks about surface temperature. [Alan Robock, United States of America]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1}</p> <p>As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.</p>
88449	45				Figure SPM.1 - What is meant by Paleo GMST warming as data are presented for modern instrumental period - is this proxy data (e.g tree rings) rather than direct observation. Also shouldn't it be Arctic Sea Ice Area. The direction of the trend + or - doesn't need to be given if you say increase or decrease. [Sharon Smith, Canada]	<p>Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.</p> <p>Note that the time series in Fig SPM.8 now says 'sea ice area'.</p>
32397	45				The figure contains misleading results: PALEO-GMST is given as +0.65°C, while GMST increasing +1.1°C is given. This is explained in the caption, but for the PALEO-GMST in the figure the year should be added in the label, i.e. +0.65°C (2000) [Olaf Eisen, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
78991	45				Figure SPM 1: The "paleo-GMST" curve appears significantly different from the more detailed information in figure SPM.4 on the same topic. Please ensure consistency. The version in figure SPM.1 is missing information about uncertainty; we suggest copying the data from SPM.4 to SPM.1. [Martine Vanderstraeten, Belgium]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32399	45				In addition the work of Eunice Foote should be cited as well, which precedes that of Tyndall by several years. [Olaf Eisen, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Note however that Eunice Foote is mentioned Figure 1.6, in Chapter 1.
132003	45				Figure SPM.1 is nice but has the dilemma of treating different compartments of the climate system differently: First it uses GMST (also used by SPM.4), how does that match the move to GSAT? Second it reports temperature for air, but heat for the ocean (here adding SST would be more meaningful for impact assessments). Earlier cherry blossom would be an impact of climate change and not exactly in the mandate of WGI. If maintained, reference to detection and attribution in the sense used by WGII should be made. [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers. Moreover, changes in GSAT and GMST were re-assessed following the SOD review and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.
107947	45				fig spm-1: scale of tropospheric warming is a bit lost, it's too far from the data when stuck over on the left [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
81877	45				Figure SPM.1 presents a set of very useful indicators all in one graphic. Most of the indicators are presented in absolute terms down the right-hand side. One exception is CO2 which is presented as a % change not in + (x) ppm. Suggest the change in ppm is shown, either instead of, or in addition to the % change, as a % change on its own is almost meaningless. Also, suggest that the Arctic sea ice indicator in the figure is changed to match the descriptor used in the caption i.e. "sea ice extent" [not "sea ice melting"]. The comment above regarding % change also applies to the Arctic sea ice indicator. The last line of the caption should say "sea ice extent declined...." [not "sea ice declined...."] [Dan Zwartz, New Zealand]	Not applicable. Fig SPM.1 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
69451	46	0	46	0	It is better change "Carbon Dioxide" in the figure to "Carbon Dioxide Concentration", and "Air Temperatures" to "Troposphere Air temperatures" . [Kaoru Magosaki, Japan]	Not applicable. Figure no longer exists in the revised SPM.
104315	46	0	46	0	Figure SPM.3: It would be informative to mention what "physical effects of land-use change" are included beyond albedo. [Philippe Tulkens, Belgium]	Taken into account. The revised figure (SPM.2) clarifies that this refers to land use reflectance.
86153	46	0	46	0	Figure SPM 2: consider adding ocean acidity and oxygen? What about adding the proportion of category 4&5 cyclones / total? Even if the statistical 'emergence' is not yet high confidence, the effects of cyclones are catastrophic, and the pattern is emerging clearly toward higher intensity. Likewise, wild fires are catastrophic and have public attention. Can this be added too? Remembering that the SPM is the main communication tool? What about some other natural phenomena that are now included in CMIP6? That have feedbacks on climate? Like permafrost, drought – a summary of all the evidence? [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Figure no longer exists in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
90263	46	0	46	0	Figure SPM2. The numbers and the message of this figure are repetitive, they are the same as on SPM1. Uncertainty could be added to the SPM1 figure as well. [Bernadett Benko, Hungary]	Taken into account. Figure no longer exists in the revised SPM.
79355	46	0	46	0	Figure SPM.2 (SPM-46) The lack of period/date since the observed change will likely mean that this figure gets misrepresented despite the note in the figure caption that it refers to Figure SPM.1. It is likely that this figure will be used on its own and presented as changes since 1850. It would be better to include in the figure itself for each component "since XXXX" with XXXX being the date. [Jaime Toney, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure no longer exists in the revised SPM.
131857	46	0			figure SPM2. please clarify the time series is cherry blossom in Japan [Hans Poertner and WGII TSU, Germany]	Not applicable. Fig SPM.2 removed from revised SPM, to shorten the document and focus on what matters most to policy-makers.
97461	46	0			Very useful figure, and we are looking forward to further refinements, including an indication of the relevant time periods. [Nicole Wilke, Germany]	Noted but figure removed from revised SPM, to shorten it.
97463	46	0			Figure SPM.2 caption: please, add information on what the figures show (trend or climate change signal between two time slices, time period, etc.) to the figure caption. [Nicole Wilke, Germany]	Not applicable. Figure no longer exists in the revised SPM.
8211	46	1	46	1	Is surface temperature for land only, as the figure suggest? Since 1850? [Frank Dentener, Italy]	Not applicable. Figure no longer exists in the revised SPM.
79949	46	1	46	1	Figure SPM.2. This figure is closely related to Figure SPM.1 (in terms of content), therefore suggest making this link more deliberate. Rename SPM.1 A and B? The intent of this figure is not clear to me. What does this figure add to that already set out in SPM.1? Suggest making this differential clearer (I note that this figure is in development but focusing on the intent of the figure could assist the further development process considerably). [Eamon Haughey, Ireland]	Not applicable. Figure no longer exists in the revised SPM.
104317	46	1	46	1	Is surface temperature for land only, as the figure suggest? Since 1850? [Philippe Tulkens, Belgium]	Not applicable. Figure no longer exists in the revised SPM.
96915	46	1	46	1	It may be useful to anchor Fig SPM.2 with the energy budget % changes lifted from Box 9.2, so ocean, cryosphere, atmosphere and land to weave a more quantitative perspective through the SPM [Paul Durack, United States of America]	Not applicable. Figure no longer exists in the revised SPM.
83363	46	1	46	1	This schematic is not depicting indicators of change across all components of the Earth System. Rather, it is northern hemisphere-centric. This detracts from its effectiveness. Suggestion - please include a second scvhematic that is specific to the Antarctic and Sputhern Hemisphere. [Robert Massom, Australia]	Not applicable. Figure no longer exists in the revised SPM.
41183	46	1	46	1	While I like this figure and the animals are an interesting addition, as this report deals with anthropogenic changes, I was surprised that there were no humans in this figure. [TSU WGI, France]	Not applicable. Figure no longer exists in the revised SPM.
87281	46	1	46	1	Fig SPM.2: The Kyoto cherry blossom date is a very local indicator. We advise to skip. [Marcel Berk, Netherlands]	Not applicable. Figure no longer exists in the revised SPM.
23287	46	1	46	1	Figure SPM.2: what is the time frame for these changes? [Zhenzhong Zeng, China]	Not applicable. Figure no longer exists in the revised SPM.
130297	46	1	46	1	Sea ice area decline noted in Figure SPM.2 should be "Arctic sea ice decline" as in Figure SPM.1. It is incorrect to call +430 ZJ "ocean warming"; this number specifically refers to "ocean heat content". [Trigg Talley, United States of America]	Not applicable. Figure no longer exists in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130299	46	1	46	1	Consider drawing inspiration from the Indicators graphic in Volume II of the Fourth National Climate Assessment to provide a more complete picture of "Indicators of Change": https://nca2018.globalchange.gov/chapter/1#fig-1-2 [Trigg Talley, United States of America]	Not applicable. Figure no longer exists in the revised SPM.
87021	46	1	46	2	Figure SPM 2: We appreciate how this figure is related to figure SPM 1. Perhaps this could be made clearer with the use of colours or icons on the text labels in figure SPM 2. [Oyvind Christophersen, Norway]	Not applicable. Figure no longer exists in the revised SPM.
87023	46	1	46	2	Figure SPM.2: Good and illustrative summary. Please consider to include something similar for the different SSPs at different future time periods (e.g. 2030, 2040-2060 and 2080-2100). Here you could also change the background schematics e.g more/less snowcover, more/less arid areas, more/less forest degradation etc. We encourage you to try to graphically visualize how the different scenarios would influence the world. [Oyvind Christophersen, Norway]	Not applicable. Figure no longer exists in the revised SPM.
109319	46	1	46	50	SPM.2: excellent, but it looks you're including tropospheric warming (+0.67) as "air temperature" over the satellite era only, while surface temp covers 1850-present. Same issue for all the other indicators. Having a hodgepodge of different timespans covered in a graphic of this type seems like a recipe for confusion. You could indicate the timespan directly in the figure if you keep the "air temperature" label. [Paul Edwards, United States of America]	Not applicable. Figure no longer exists in the revised SPM.
74021	46	1	46	60	Figure SPM.2 lacks to indicate to which year are the given values of change for the various parameters, referenced (1992-2014 ?) [Sergiu Dov ROSEN, Israel]	Not applicable. Figure no longer exists in the revised SPM.
29203	46		46		The caption of Figure SM.2 might give information of the time difference (from when to when) for the self-containment. [Hiroshi Kanzawa, Japan]	Not applicable. The figure no longer appears in the revised SPM.
9569	46		46		Too many versions of temperature given. Most people do not know the distinction between air temperature and surface temperature. Some people might see the 0.67C warming and be confused. I think it should be very clear – just stick to surface temperature warming for a summary figure like this. [Joelle Joelle Gergis, Australia]	Not applicable. Figure no longer exists in the revised SPM.
104319	46		46		Instead of oceans warming (expressed in ZJ), a more policy-relevant indicator such as the ocean temperature (in °C) should be used. [Philippe Tulkens, Belgium]	Not applicable. Figure no longer exists in the revised SPM.
108209	46		46		SPM.2 Needs a much better caption. [Anton Holland, Canada]	Not applicable. Figure no longer exists in the revised SPM.
54725	46		46		On Figure SPM.2, the label "Air temperatures: +0.67°C" is too vague. Replace either with "Troposphere temperatures: +0.67°C" or with "Air temperatures (0 to x km)", where x could be 6 or 10 or whatever, and make sure the figure caption specifies whether this temperature increase is for the entire troposphere or just the lower troposphere (0 to x km). If this is left unchanged, policy makers could get confused as to why this 0.67°C change is different from the +1.1°C in surface temperatures. [Nancy Hamzawi, Canada]	Not applicable. Figure no longer exists in the revised SPM.
86501	46		46		Ocean warming is given ZJ - it is very difficult to understand how much it is. If it is not possible to give it in centigrades then please give a comparison with previous levels or something similar that helps the reader to understand it [Ala Taimar, Estonia]	Not applicable. Figure no longer exists in the revised SPM.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
132415	46				Figure SPM.2: It is a nice example to mention the change in the timing of cherry blossom on the graph, but I would also add measures of changes in land climate. For instance: Warming of land temperature extremes over land (about 50% higher than mean global warming and of most relevance for impacts over land). Given that most people live on land, it would seem most relevant to provide a few indices characterizing changes in climate closest to where they live. [Sonia Seneviratne, Switzerland]	Not applicable. The figure no longer appears in the revised SPM.
42343	46				In figure SPM.2 Ocean warming change is addressed as +430ZJ. For policy makers this might be an unknown unit. Otherwise good visual presentation [Tina Christensen, Denmark]	Not applicable. Figure no longer exists in the revised SPM.
1903	46				What do you mean by Air Temperatures? How can they go up less than surface temperature, and over what period. [Alan Robock, United States of America]	Not applicable. Figure no longer exists in the revised SPM.
1905	46				The CO2 molecule is perfectly linear and not as drawn in this cartoon. [Alan Robock, United States of America]	Not applicable. Figure no longer exists in the revised SPM.
88451	46				Figure SPM.2 - If giving direction of trend with + or - and arrows then don't need indicate warming or cooling. Instead of Ocean warming with a positive value it should just be Ocean Heat Content. This would be consistent with surface temperature sea level and sea ice area. [Sharon Smith, Canada]	Not applicable. Figure no longer exists in the revised SPM.
17549	46				Is this style of figure more suited to going in the FAQs rather than the SPM? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Figure no longer exists in the revised SPM.
132005	46				Figure SPM.2 looks like the FAQ version of Figure SPM.1 [Hans Poertner and WGII TSU, Germany]	Taken into account. Figure no longer exists in the revised SPM.
107949	46				fig spm-2: air temperatures are shown, presumably these are lower or mid troposphere rather than "surface air temperature" -- need to be careful here as the report is moving from GMST to GSAT for main indicator, so surface temperature becomes surface air temperature, and air temperature is tropospheric temperature. Records for the latter are shorter, so its overall warming value is less than for the surface but this might wrongly imply that the warming rate has been much less, just the record is shorter. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The figure no longer appears in the revised SPM.
107951	46				fig spm-2: arrow for cherry blossoming earlier would be better pointing to the left rather than up (or down). Apart from deep paleo people, time moves from left to right, so earlier blossoming should point to the left! [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure no longer exists in the revised SPM.
38613	46				"Fig spm 2- Ocean warming, 430 ZJ is not correct, must relate to a time period" [Aribert Peters, Germany]	Not applicable. Figure no longer exists in the revised SPM.
79349	46				Figure SPM.2: Comment: Different increases are shown, but they do not start at the same time. It would be good to indicate since which year they show this increase. Ex: Air temperature: +0.67°C since 1979 [Rolf Philipona, Switzerland]	Not applicable. Figure no longer exists in the revised SPM.
9769	47	0	47	0	figure spm.3 is v important as it deals with a lot of the questions and misunderstandings we encounter. Another one that would be useful to build up with an animation to explain how we get to the conclusion that only net human influence explains the observed warming [Jonathan Lynn, Switzerland]	Noted. The figure has been split and heavily revised.
42047	47	0	47	0	Fig SPM.3: The use of arrows and bars together in one graph is a bit confusing. Does LUC include only anthropogenic LUC as indicated by the "Other human forcings" label? [Juhani Damski, Finland]	Taken into account, the SPM2 figure in the final SPM now presents only bars and only present effect from changes of anthropogenic origins.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86155	47	0	47	0	Figure SPM 3: why are there bars, arrows and symbols in (b)? Can they not all be represented by bars? What do the aerosols/other/ozone arrows mean? The colours are also not optimal. This figure could benefit from further visual development. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account, the SPM2 figure in the final SPM now presents only bars and error bars are shown.
79357	47	0	47	0	Figure SPM.3 (SPM-47) I have no problems with my eyesight and am not colour-blind, but have great difficulty distinguishing in the inset legend in the left panel - the differences in colours among Other human forcings, Natural forcings, and Observations. I recommend using more contrasting colours [Jaime Toney, United Kingdom (of Great Britain and Northern Ireland)]	See 111007
131859	47	0			Fig SPM.3 'and in an emulator' what is this? Could this term be defined in SPM [Hans Poertner and WGII TSU, Germany]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
131861	47	0			Fig SPM.3 - the use of difference ref periods is confusing - in the footnote on page the modern period is defined as 1995-2014 and it is specified that the historical period in CMIP6 ends in 2014, here the current period is 2010-2019 [Hans Poertner and WGII TSU, Germany]	Taken into account, the SPM2 figure in the final SPM presents the GSAT change due to emission change between 1850-1900 and 2010-2019.
82531	47	0			Which GSAT time series is used in Figure SPM.3? [Blair Trewin, Australia]	Taken into account. It is the average of the assessed datasets in the revision
97465	47	0			Please optimise legend and colours, they could be the same in both figures. [Nicole Wilke, Germany]	Taken into account, the SPM2 figure in the final SPM has been optimised graphically.
80395	47	1	47	1	Color legend should be included in the right panel [Paola Arias, Colombia]	Taken into account, the SPM2 figure in the final SPM has been optimised graphically.
8213	47	1	47	1	Suggest to delete the emulator part- seems like a technical detail [Frank Dentener, Italy]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
50457	47	1	47	1	Figure SPM3: the way in which 'greenhouse gases' and 'other human forcings' are totalled from the subcategories is unclear - it might be clearer to use a stacked bar chart with different colours contributing to the different contributors. While it is noted in the text that the contribution from each arrow do not equal the total of the shaded bar, it is unclear why this is so and makes comparison of the data very difficult. It would be very helpful if way could be found to reconcile these data if possible. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the figure SPM2 in the final SPM now clearly shows separately the effect of individual components.
23355	47	1	47	1	Figure SPM.3, right panel: Difficult to distinguish which arrows corresponds to "LUC", "others" and "ozone". There is a risk that the entire bar is interpreted as LUC with the current placement of "LUC". Perhaps "other" and "ozone" could start from the 0? [Anna Amelia Sörensson, Argentina]	Taken into account, the figure SPM2 in the final SPM now clearly shows separately the effect of individual components.
104321	47	1	47	1	Suggest to delete the emulator part- seems like a technical detail [Philippe Tulkens, Belgium]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
97467	47	1	47	1	Figure SMP.3: Left Figure: Light green shading is hard to see. Right: dark grey and light grey look quite similar. Please use optimised colours, related to the left figure. [Nicole Wilke, Germany]	See 111007
97469	47	1	47	1	Figure SPM.3 right: We suggest introducing an optical separation (e.g. vertical dotted line) between "net human influence" and the other specific forcing factors to the right. The first two columns can be directly compared, whereas the other columns to the right are of the kind [net human influence] "of which ...". [Nicole Wilke, Germany]	Taken into account, the figure SPM2 in the final SPM now clearly shows separately the effect of individual components.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130301	47	1	47	1	For the right panel of this figure, is it possible to label directly onto the figure or at least include in the figure captions that positive values suggest a greater influence of warming occurred in 2010-2019 and vice versa for the negative values? [Trigg Talley, United States of America]	Taken into account, the SPM2 figure in the final SPM has been optimised graphically.
130303	47	1	47	1	Strongly consider drawing inspiration from Figure 2.1 of the Fourth National Climate Assessment: https://nca2018.globalchange.gov/chapter/2#fig-2-1 . That figure decomposes the natural vs human drivers of climate and then combines them to clearly illustrate the human influence on climate change. The existing panel is helpful, but there is a lot going on in a single panel. [Trigg Talley, United States of America]	Taken into account. The time series has been simplified.
87025	47	1	47	2	Figure SPM 3: The leftmost figure presents "greenhouse gases" and "other human forcings", whereas the rightmost figure presents "net human influence". Please improve consistency between the figures. Also please use the same colours for the same categories in the two figures. Please make the observations stand out more, as they are the sum of all the forcings. The caption could do with some refinement. For example, what are 'other human forcings' (can you give an example?), what is meant by an 'emulator', and spell out what is meant by 'ERF' changes. [Oyvind Christophersen, Norway]	Taken into account. Figure simplified and panels now contribute to two separate figures which should reduce confusion.
77107	47	1	47	10	The absence of a figure which shows the RF (or ERF) for different atmospheric species is problematic. The AR5 figure was too complex but this figure does not contain enough detail. Consider adding another figure which shows information in the standard IPCC format. [Emer Griffin, Ireland]	Forcing can give a misleading picture of historical contribution to temperature. In an advance over AR5, emulators, calibrated to ERF and ECS estimates from Chapter 7, have been used to assess temperature change directly. This synthesis presenting the effect on surface temperature of emission changes associated to each primary compound is more informative for decision makers.
77109	47	1	47	10	The implications of move to ERF from RF could be shown in a figure also. This would assist in understanding its implications. [Emer Griffin, Ireland]	Forcing can give a misleading picture of historical contribution to temperature. In an advance over AR5, emulators, calibrated to ERF and ECS estimates from Chapter 7, have been used to assess temperature change directly. This synthesis presenting the effect on surface temperature of emission changes associated to each primary compound is more informative for decision makers.
78595	47	1			it seems odd to have attribution of temperature change before showing the temperature change itself. Suggest you switch the order of figures 3,4. [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The new fig SPM.1 now shows the temperature change (a) in a paleo context then the human attribution (b)
109217	47	1			SPM.3 -- The relationships between the two graphs and within the data sets in the bar graph are unclear. Use color to associate similar concepts. Maybe consider integrating the two graphs -- right-side of the left graph could instead show the final range and a complete sentence to summarize the impacts (similar to popular forcings-over-time stacked graphs, but can be done more accessibly if accompanied by explanatory text) [Steph Courtney, United States of America]	Taken into account. Figure has been split into two figures and combined with aspects of figure SPM.4
2927	47	20	47	25	Suggestion is add a figure here, i.e. Chapter 3 Figure 3.8. It is not only show the global, but also each Continental. [Zong Ci Zhao, China]	Rejected. The figure has already been criticised as too complex, the idea of to simplify the revised SPM, not add more complexity to them.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50459	47	SPM3	47	SPM3	In the annotation of Fig SPM3: 'physical effects of land-use change' - does this also include land response to increased CO2 in the atmosphere, i.e. autonomous rather than human-forced land use change? Or both types. Grateful if you could clarify this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the label of x-axis of SPM2 figure in the final SPM clarifies this point. The land use component is now labelled "Land-use reflectance and irrigation" as the CO2 increase associated to land-use changes is considered in the CO2 emission component.
89659	47		47		Figure SPM.3 is really confusing, and I think policymakers will really struggle with it. It must be clarified that the estimates that are now shown with bars and arrows represent two different and complimentary approaches, and temperature changes from each approach should be displayed in the same way (with bars), including CIs for both. [Trude Storelvmo, Norway]	Taken into account, the SPM2 figure in the final SPM now presents only bars.
104323	47		47		Figure SPM-3 is clear and policy-relevant, and should be kept in future versions. [Philippe Tulkens, Belgium]	Noted.
111007	47		47		SPM Figure 3 - left pane - is not accessible for people with colorblindness. Please consider a different color scale. [Monica Dean, United States of America]	Accepted. Care taken over colour-blindness accessibility of all figures
54727	47		47		Figure SPM.3: LH panel - for the SPM, since simplicity of Figures is desirable, are both the CMIP6 results and the emulator results needed in the SPM version of this Figure? Both sets of results convey the same message. RH panel: The boxes and arrows for the category "other anthropogenic forcings" are very hard to understand and see. It is confusing to see factors that contribute warming effects (ozone, SWV etc.) shown below the zero line. Perhaps the authors could find an alternate way to stack the arrows. The LUC label needs repositoning as it looks to apply to the total uncertainty line. [Nancy Hamzawi, Canada]	Accepted. Figure has been substantively simplified.
80085	47		47		The Figure should be revised, left panel has no reference period. Instead of other human forcings please write aerosols. Right panel is not straightforward with the labelling. [Lilian Fejes, Hungary]	Taken into account. Figure has been split across two figures in FGD and labelling improved.
86505	47		47		Figure SPM3 - a useful figure, but not easy to understand. Perhaps the design could be improved to make it clearer and separate the impacts of separate GHGs more clearly [Ala Taimar, Estonia]	Taken into account. Figure has been substantively simplified and clarified and contents split across two figures for comprehensibility.
14577	47		47		What is the added value of the emulator results (dashed line) for the average policy maker in Figure 3 (left panel) [Roshanka Ranasinghe, Netherlands]	Taken into account. Emulator results removed.
112703	47				excellent figure. It would be important to clarify that the emulator gives best guess only [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
111705	47				Fig. SPM.3. This is a nice figure but I think it is rather 'busy' and will be hard to present e.g. in a ppt presentation. In particular the 'Other Human forcings' bars are hard to discern. Given the importance and profile of aerosols and their uncertainty, is it possible to have a separate bar for aerosol? Also, the difference between the sum of the emulator results for 'Other human forcings' and the assessed best value is quite large. Again, showing aerosol separately if possible would clarify where that discrepancy was coming from. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Its presentation has been substantively simplified and it is now split across SPM.1 and SPM.2. figures.
1907	47				Why are there no error bars on aerosols in the right panel? Why are they drawn with arrows, but LUC gets a big blue box? [Alan Robock, United States of America]	Taken into account, the SPM2 figure in the final SPM now presents only bars and error bars are shown.
9641	47				I do not get the arrows for the "other human forcings" [Olivier Boucher, France]	Taken into account, the SPM2 figure in the final SPM now presents only bars and error bars are shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
107953	47				fig spm-3 right-panel: take a look at the global carbon project figures (http://folk.uio.no/roberan/img/GCB2019/PNG/s54_2019_Waterfall_sources_and_sinks.png) for the contributions to increased CO2 and perhaps adopt something like that for the breakdown shown by the bars for GHGs, other human and natural. Rather than putting multiple components on bars (CO2, CH4 etc.) put them on adjacent bars starting where the previous one ended. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the SPM2 figure in the final SPM has been optimised graphically.
110813	47				an emulator : means? [cathy clerbaux, France]	Taken into account, 'emulator' is no longer mentioned in the revised SPM.
9771	48	0	48	0	that box in panel B of figure SPM.4 is very important -- each of the last 4 decades... (it was each of the last 3 in AR5). Also complicated at first sight especially bringing in the long term history, so another one to build up [Jonathan Lynn, Switzerland]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
111495	48	0	48	0	Nice figure, but the way the LGM is indicated is problematic. At first glance it seems to suggest the mean temperature during the LGM was more than one degree above the reference temperature, similar to the LIG. Could the horizontal solid line be removed and the text positioned above the dashed vertical line? Also, it is not clear what the reference period is, i.e. what does the "zero" refer to? This should be stated in the caption. [James Renwick, New Zealand]	Taken into account. The revised SPM figure no longer includes LGM. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
79359	48	0	48	0	Figure SPM.4 (SPM-48) Note a typo in the last interglacial text (change from "integlacial"). The colour scheme for the paleoclimate points for in A should be different from the gold: borehole temperatures and red: thermometers [Jaime Toney, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. "Last Interglacial" no long used; colours were revised
97471	48	0			Figure A shows large natural paleoclimate T-diff, but does not visually convey the much longer time scales of these changes. Please use different the colours. [Nicole Wilke, Germany]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
97473	48	0			Figure B is very useful and builds on the AR5. [Nicole Wilke, Germany]	Noted.
97475	48	0			Why are the 2 figures interlaced? It is confusing that the axes do not match. [Nicole Wilke, Germany]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130305	48	1	48	1	This figure is confusing, especially plot A. Recommend removing plot A and only showing plot B. [Trigg Talley, United States of America]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
131863	48	1	48	1	Showing three or more almost similar graphs in one diagram makes no sense to me, if they blurr into each other - just as your graphs of proxy records, thermometers and borehole temperature do here. I know, you want to communicate that all three of them show the same development, but if you want to highlight this, you should zoom in here instead of printing some blurry lines that do more confuse than explain anything. [Hans Poertner and WGII TSU, Germany]	Accepted. Figure SPM.1a in the revised version only shows 1 curve for the reconstructed temperature and 1 curve for the observed temperature.
8215	48	1	48	1	Temperatures in GMST? The introduction says the default is GSAT. [Frank Dentener, Italy]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
50461	48	1	48	1	It appears that a lot of the information contained in figure SPM.4 overlaps with that in SPM.1 (both have a section showing temperatures over the last 2,000 years. SPM.4 additionally shows differences between data sets (which is not necessarily helpful for an SPM - a synthesis of all these data sets into a single conclusion is more helpful), while also showing other dates e.g. mid-holocene, which a policymaker will not understand the relevance of. This would possibly be better replaced with a graph synthesising all the different data sets to give best estimates of temperatures over the entire historical record that we have any data for (with a logarithmic scale to make recent changes more obvious), thus showing the timescales since global temperatures were last at various levels. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
23357	48	1	48	1	Figure should be improved so that it is clear that all elements of A belongs to A. In this version it took me a while to realize that the leftmost y-axis belong to A. Different scale of leftmost y axis above and below 0 is a problem. Sorry not to be able to provide any suggestions right now, just pointing this out. [Anna Amelia Sörensson, Argentina]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
79951	48	1	48	1	Figure SPM.4. While the intent seems clear enough interpretation of this figure is difficult. Suggest a major reorganisation of the data presented to simplify the figure. Separation of panel A and B may help. I note the valid attempt here to make best use of space with the insertion of Panel B - however the figure is very dense and the axis structure requires much effort from the reader to interpret. [Eamon Haughey, Ireland]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
104325	48	1	48	1	Temperatures in GMST? The introduction says the default is GSAT. [Philippe Tulkens, Belgium]	Not applicable. The term 'global surface temperature' is used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend.
97477	48	1	48	1	Figure SMP.4: Colours are repeatedly used for different information, which is confusing. Please improve. [Nicole Wilke, Germany]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
76789	48	1	48	3	Figure SPM 4: Great figure. The error bars on the LIG and LGM dots don't match the text beside them. The text about the rate being unprecedented in at least the last 2000 years would also apply to reconstructions of the full Holocene with the same level of confidence. And would possibly also apply to deglacial warming with lower confidence? [Nerilie Abram, Australia]	Taken into account. LIG and LGM are no longer used. The conclusion regarding the rate of change is restricted to time series based on annually resolved data.
87027	48	1	48	20	Figure SPM 4: A: Please be careful when stretching the y-axis, and please be careful about use of colours. It seems like red denotes both last interglacial temperature and also temperatures measured with thermometers. Same goes for orange. B: Please consider if it is necessary to display both the running temperature curve and decadal means. General comment: Give the figure a title, saying it concerns temperature. Also please consider to include the intent with the figure. Is it possible to connect panel B to the rightend of panel A? Perhaps some diagonal lines from the corners of B and up to where on A's timeline they belong. This will better show where in the long timeseries we have the five datasets. [Oyvind Christophersen, Norway]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
78597	48	1			figure 4 is nice and contains lots of information. I found the inset of panel (B) makes it hard to take in all of panel (A) – especially the LGM spot hidden way down to the bottom left. I know this makes efficient use of space, but it makes the figure hard to read. Can you separate panels A and B better? [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
109219	48	1			SPM.4 -- This layout of A and B is too cluttered and overwhelming. Greater separation would be useful, as well as not using the same color codes for past climatic events and data sources. In-graph text is too long, ideally save that formalized language for the caption and have only a single, more declarative sentence in-figure, but I understand that may be limited by political consensus. Contextual info on far-right side of B is helpful, but it would be better to keep B data as far to the right as possible instead, to aid association between B and recent A data (currently that link is not visually evident). In A, y-axis break is also confusing and probably unnecessary. Overall, to aid cluttering, small changes could help, but consider either A. omitting the LGM (and then probably the LIG too?) or B. spacing A and B out much more, possibly taking up a whole page total. [Steph Courtney, United States of America]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
37721	48	2	48	2	Figure SPM.4 uses the same colors for thermometers and the last interglacial (red) and for borehole temperature and the mid Holocene (gold). This could be confusing to the reader. It might be worth changing the colors used for the thermometers and the borehole. [Stephanie Arcusa, United States of America]	Taken into account. Colours scheme was revised and simplified.
67693	48	2	48	2	Integracial --> Intergracial, which is placed at the most top left in Figure SPM-4A. [Hiroaki Kondo, Japan]	Taken into account. "Interglacial" no longer used.
32365	48	2	48	2	"r" missing in Interglacial in Figure SPM.4 A [Clemens Schwingshackl, Norway]	Taken into account. "Interglacial" no longer used.
4091	48	2	48	2	typo, integracial -> interglacial ? [Daoyi Gong, China]	Taken into account. "Interglacial" no longer used.
105131	48	2	48	3	typo on figure SPM.4: integracial => interglacial [Masa KAGEYAMA, France]	Taken into account. "Interglacial" no longer used.
105133	48	2	48	3	instead of precise date for paleoclimates, it would be better to give intervals [Masa KAGEYAMA, France]	Accepted. Ages of intervals are now stated.
105135	48	2	48	3	add the mid-Pliocene and the Eocene? [Masa KAGEYAMA, France]	Rejected. Temperatures for older reference periods are presented in Box TS.2 and in CH2
79351	48	2			Last Interglacial (125,000 years ago) Comment: Last Interglacial [Rolf Philipona, Switzerland]	Taken into account. "Interglacial" no longer used.
28113	48	5	48	5	Please replace "shows" by "is to show". [Eric Brun, France]	Not applicable. Text thoroughly revised.
97479	48	12	48	14	Fig SPM.4: The "bars are +/- 2SD" associated with the "large circles" have wrong length and/or are mislocated with respect to circles, if the 2SD-values also depicted in the figure are correct. [Nicole Wilke, Germany]	Taken into account. Temperature ranges are depicted correctly in revised figure.
131865	48	13	48	13	Units like "SD" are difficult to decode for non-scientists. You would help them if you use "Standard Deviation" instead, this would give them to chance to at least google, what you are talking about. [Hans Poertner and WGII TSU, Germany]	Taken into account. Removed "SD" from caption.
23359	48	15	48	16	I wonder if the "resolved" in Annually resolved temperatures" does not confuse more than help the reader. [Anna Amelia Sörensson, Argentina]	Not applicable. Text thoroughly revised.
50463	48	SPM4	48	SPM4	Typo: Figure label (in red): 'Last Interglacial' [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM figure no longer includes the Last Interglacial
112921	48		48		The reference to the LGM temperature in this figure is extremely misleading. The blue bar appears to mark an LGM temperature change of +1.2C. I understand the intent, but I wonder if including LGM temperatures on this plot is even possible, without a) wasting space, and b) introducing ambiguities. Also, in this Figure I would think that the instrumental temperature might go on top of the paleo+instr panel, bc they are included in the paleo panel but are illegible therein. Also, the blue background on the paleo figure will really devalue its copy/paste potential for presentations going forward. It reduces legibility for a key figure, so I would stick to white backgrounds here. [Kim Cobb, United States of America]	Taken into account. The revised SPM figure no longer includes the LGM

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7739	48		48		Figure SPM.4: It is noted that the term "anomalie" is used - however, no definition has been included in the glossary. [Klaus Radunsky, Austria]	Taken into account. The revised SPM figure no longer includes the term "anomalies."
7741	48		48		Figure SPM 4: In the text: "Five global data sets agree" it is strongly suggested to delete "agree" - The reason being, that no criteria for agreement has been specified and that it seems that the agreement is of different quality in the years included. [Klaus Radunsky, Austria]	Taken into account. The revised SPM figure no longer includes the header.
7743	48		48		Figure SPM.4: The text starting "over the last 50 years GMST has increased at an observed rate unprecedented in at least the last two thousand years" should be reconsidered. The reason being, that the time resolution of these values is unclear; therefore the rate of temperature change cannot be easily compared. It would be important to use the time resolution over the whole time period and only then the differences in rate of change or in absolute values could be compared. [Klaus Radunsky, Austria]	Rejected. The observed (proxy-based) temperature reconstruction is resolved at annual scale and then decadal smoothed. The same procedure was used for the instrumental data. Therefore the rate of change is compared using equally resolved time series.
7745	48		48		Figure SPM.4: The text starting "and it is about as likely as not that no multi-centennial period since the last inter-glacial period (125 ka) was warmer globally than the most recent decade" should also be reconsidered because it is not appropriate to compare multi-centennial periods with a decade. Instead it is suggested to construct centennial average values and compare the most recent centennial average (e.g. from 1919 to 2019) with earlier centennial values. [Klaus Radunsky, Austria]	Taken into account. SPM footnote 13 in the final (approved) SPM explains the rationale for comparing long-term changes with recent and future changes: "As stated in section B.1, even under the very low emissions scenario SSP1-1.9, temperatures are assessed to remain elevated above those of the most recent decade until at least 2100 and therefore warmer than the century-scale period 6500 years ago."
7747	48		48		Figure SPM.4: Please, explain the periods for which the temperature indicated of the last interglacial (125.000 years ago) and the last glacial maximum (21.000 years ago) are representative (I assume it is a longer time period than 100 years?). And you should put these values in context with current temperature covering a similar long time period. [Klaus Radunsky, Austria]	Taken into account. The revised SPM figure no longer includes either term.
7749	48		48		Caption to figure SPM.1 b: All temperatures are anomalies relative to the 1850-1900 reference period. It is suggested to delete the term "anomalie" because it has not been defined and it might imply that any deviation from the 1850-1900 reference period is the result of anthropogenic activity. The term "anomalie" - if used at all should be limited to values resulting from human activities only - based on robust attribution studies. [Klaus Radunsky, Austria]	Taken into account. The revised SPM figure no longer includes the term "anomalies."
9571	48		48		This figure is too confusing for a figure featured in the SPM. Does the red refer to last interglacial or thermometers? Note that the caption lines 15-15 should read 'annual' not 'annually resolved' (our audience is not a group of palaeoclimatologists, it's policy makers). [Joelle Joelle Gergis, Australia]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
104327	48		48		Figure SPM-4 would be more informative and meaningful if x-axis represented really 125 000 years, without any interruption. [Philippe Tulkens, Belgium]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
26037	48		48		FIGURE SPM.4. The figure is somehow misleading. Perhaps, it could be improved either with two clearly differentiated parts or better with the lower part zooming from x-axis around year 2000 and moving the text in-between possibly to the right (as in the bottom graph) [Don Alfonso Pino Maeso, Spain]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
54729	48		48		Figure SPM. 4: Both these panels are straightforward if presented separately. By trying to combine them, the Figure has been made unnecessarily complicated. It appears that, if the results for the last glacial maximum were removed, then there would be no need to have the vertical axis extend all the way down beside the lower panel (panel B). Then the two panels could just be stacked, with no overlap and this would be much simpler to interpret. The global temperature during the last glacial maximum is arguably not very relevant for understanding current climate warming. [Nancy Hamzawi, Canada]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
80089	48		48		Instead of A. and B. it is written (a) and (b) in the figure description. A. Omit the description written under the figure (Over the last 50 years...); red line with bars: correct to interglacial, bars do NOT represent ± 0.5 C in the figure; blue line with bars: in the description it is written 20000 instead of 21; The line descriptions on the right could be closer to the representing lines to avoid confusion. [Lilian Fejes, Hungary]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
86507	48		48		Figure SPM4 - this figure largely repeats information in figures SPM1 and SPM3 and could be omitted [Ala Taimar, Estonia]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
112705	48				The last millennium simulations would add quite a bit here in terms of how well we understand past climates. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The last millennium simulations are shown in Box TS.2
111707	48				Fig SPM.4. It's nice to have a 'one stop shop' for this information but the figure as it stands looks quite complicated. A simple suggestion to improve the presentation would be to have some lines from the time axis of the upper panel joining 1850 and present day to the lower panel - to make it clear visually that the lower panel is a zoom in to the end of the upper panel [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The revised SPM has been significantly shortened and the figures have been completely revised to produce a consistent visual narrative that supports the SPM. Moreover, the new figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible.
42939	48				I have noted in Ch 2 and 9 that the assessment of LIG warming of 1.5 ± 0.5 is not robust. I would suggest 1 ± 1 for reasons explained under Ch 2. [Eric Wolff, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Assessed temperature was revised downward.
110815	48				2sigma instead of 2SD [cathy clerbaux, France]	Taken into account. "SD" no longer used in the figure caption.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111497	49	0	49	0	The pixels in the right column plots are small and hard to make out. I appreciate they represent the grid scale, but if it was possible to make them larger or more bold, that would help readability. [James Renwick, New Zealand]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
86157	49	0	49	0	Figure SPM 5: a really clear map is called for here for the SPM. Leave the stippling and crosses that show confidence for the chapter. [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C. On stippling and hatching - accepted, this is no longer shown in the SPM figures.
131867	49	0			SPM.5 for observed precipitation, the values round 0 are white - how can the reader differentiate between no data and no trend [Hans Poertner and WGII TSU, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
8217	49	1	49	1	Right hand figures are hard to read. [Frank Dentener, Italy]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
50465	49	1	49	1	In figure SPM5 RHS precipitation change plots, it is not clear whether in most areas of the world there has been no trend, or whether there is no data to plot (as most of the map looks white). An alternative colour scheme could be chosen to remedy this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
23361	49	1	49	1	This figure, if chosen, should probably be backed up by some explanations. For most regions, T has a long term warming trend for the period 1900-1980 that has increased during recent years (1981-2018). On the other hand, for precipitation, regional trends will likely be larger when looking at a multi-decadal-scale period (as in lower panel right) than at a centennial time scale (as in upper panel right) independent of period chosen (1900-1938 instead of 1980-2018 e.g.), due to internal multidecadal variability. But, by presenting the figures like this, side by side, it could be mis-interpreted like "both P and T trends are increasing". (Also: is the period for T 1900-1980 while for P 1901-2016? Why this difference?) [Anna Amelia Sörensson, Argentina]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
104329	49	1	49	1	Right hand figures are hard to read. [Philippe Tulkens, Belgium]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
97481	49	1	49	8	Fig SPM.5: In some regions of the world changes in precipitation seasonality were observed rather than changes in the annual precipitation sum. For the readers of the SPM, the seasonal redistribution of precipitation is an important message that should be visualised. We suggest to include maps on summer/winter precipitation sums. In addition, in the title of the upper left panel 2016 should presumably be exchanged with 1980? [Nicole Wilke, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
97483	49	1	49	8	Fig SPM.5: The resolution of this figure is too poor as to identify crosses of significance. [Nicole Wilke, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that stippling and hatching is no longer shown in the SPM figures (but are included in the chapter figures).
130307	49	1	49	10	The precipitation panel is nearly impossible to read. [Trigg Talley, United States of America]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.

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87029	49	1	49	10	Figure SPM 5, right panels: It seems like there is less change over the periode 1901-2016 (top panel) than over 1980-2016 (bottom). Is this correct? What is the message you want to convey by showing two figures with different time intervals, where one also covers the other period. Please include a clear title and purpose upfront to help the reader. [Oyvind Christophersen, Norway]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
20937	49	1	49	11	More clarification is needed. At the top of Figure SPM 5, it is written Observed temperature change and Observed Precipitation change, while at the bottom it is written "Trend (0C per decade) and Trend (mm yr-1. per decade) . Not clear which is correct. We need to reconcile and be consistent. [Ladislav Chang, United Republic of Tanzania]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
40313	49	2	49	3	For the figure SPM 5 on the top right "observed precipitation changes" : the period should be "1901-1980" instead of "1901-2016" [TSU WGI, France]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
54731	49	2	49	3	The heavy black contour separating reds from blues is very distracting and potentially misleading (drawing particular and unwarranted attention the small regions where change is near zero but slightly negative. Please replace with a normal thickness contour line. [Nancy Hamzawi, Canada]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
78667	49	4	49	4	In figure SPM.5: just to make sure: where there is a cross, data is statistically significant. So the precip.-data are not statistically significant? If that is so, fine, if not, something is off in the plot or the caption. Please check! And maybe think about saying this explicitly in the caption. [Heike Wex, Germany]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that stippling and hatching is no longer shown in the SPM figures (but are included in the chapter figures).
50469	49	7	49	8	where sufficient data exists' - so could you say that it looks worse recently but just because there's more data points in the RHS bottom map? Could be seen as a bit misleading. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that stippling and hatching is no longer shown in the SPM figures (but are included in the chapter figures).
50467	49	SPM5	49	SPM5	Fig SPM5 bottom LHS map: is the upper limit for the darkest red bit of the colour bar 0.8 degrees? (i.e. no obs in Arctic support more than 0.8 per decade warming since 1981?) If so it would be helpful to add -0.8 and 0.8 to the bar. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
112923	49		49		In upper right panel, precip trend should presumably be labelled 1901-1980. Also, whatever markers are plotted in this panel are impossible to see. [Kim Cobb, United States of America]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
7751	49		49		Figure SPM.5: It seems that the authors wanted to inform about the change in the rate of change with respect to temperature and precipitation. The rate of change for an 80 year period is compared to the rate of change in a 37 year period. This seems to work for many regions with respect to temperature but does not work for precipitation - because the lack of crosses indicates that there are no significant changes at all. Either the uncertainty can be reduced - e.g. by using more than one model but a set of models; or the figure should be limited to temperature change only. [Klaus Radunsky, Austria]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
7753	49		49		Figure SPM.5: Given that this figure only works well for temperature it might be more appropriate from a methodological point of view to provide the results for temperature for three 40 years periods, e.g. 1900 to 1940, 1941 to 1980, 1981 to 2018. [Klaus Radunsky, Austria]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.

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81227	49		49		Fig SPM.5 is not very clear [Fatima Driouech, Morocco]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that the new figure SPM.5a shows a map of observed (regional) temperature changes at a global warming level of +1°C.
104331	49		49		Instead of showing the observations from only one model/dataset, figure SPM-5 should represent the average observations for a whole set of models and datasets. [Philippe Tulkens, Belgium]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
26001	49		49		In figure SPM.5, maps are too small to clearly see the information. Also it would be useful to know exactly the areas where no data is available. Consider using the same periods for temperature and precipitation. Different periods can be misleading. [Don Alfonso Pino Maeso, Spain]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
80093	49		49		Why are the precipitation changes shown until 2016 for the right top panel (instead of 1980)? We believe the purpose of the figure is not to picture the evaluation of the observation network nor the different trends for different periods. The ending and beginning years could have been similar too maybe (1981, 2018, etc). Also, the figure has weak visibility, while the left levels as well (continental scales are hard to see). The definition of the stippling is missing. Provide it or simply avoid using it on the maps. Please provide what trend (linear?) is shown in the figures. [Lilian Fejes, Hungary]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that stippling and hatching is no longer shown in the SPM figures (but are included in the chapter figures).
110817	49		49		right plots: why 2016 and not 2018? [cathy clerbaux, France]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
86509	49		49		Figure SPM5 - not easy to understand, please improve or omit. It is already covered in Atlas. Although a figure on precipitation changes would be very useful in SPM [Ala Taimar, Estonia]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
53531	49				Fig. SPM5: It may be useful to add two maps for 1980-2018 trends in wet days frequency and intensity to illustrate that weak changes in annual mean precipitation may hide opposite trends in frequency vs intensity (to be discussed with CH8 which could show similar maps in Section 8.3). [Hervé Douville, France]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
17551	49				Reference to GPCCv8 needs to be explained. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
45215	49				It will be useful to show in Figure SPM.5, the temperature and precipitation trends for Annual, DJF and JJA seasons for the period 1981-2018, to reflect the seasonal differences in the trends. If space is a limitation, could we consider dropping the maps for the period 1900-2016? [Krishnan Raghavan, India]	Taken into account. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers.
107955	49				fig spm-5: what's the point of including cross to indicate statistical significance when the null hypothesis and alternative hypothesis are not stated? Do they indicate "detection" relative to natural internal climate variability? Or "emergence" as used elsewhere here? If they are just some unstated statistical test that will be meaningless to policymakers (e.g. null hypothesis is that the observed trends could have arisen purely from random variability that follows a first-order autoregressive model) then it would be better to remove them because they aren't conveying any useful and clearly understood message. Otherwise they may be misinterpreted to mean that the trend is bigger than the observational uncertainty, which I don't think is the intended message here? [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Stippling and hatching no longer shown in the SPM figures (but are included in the chapter figures).

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107957	49				there isn't a clear rationale for using the same colour scale for both precipitation trend maps, it implies that the long period trends are small and unimportant and wrongly implies that trends have accelerated in the record period but that's just cos it's a shorter period and thus some internal variability trends can be quite large. Unless the assessment finding is that precip changes have recently accelerated, then the current colour scale for precipitation might mislead the reader into thinking that they have.. Maybe use a scale that shows overall change from start to end of the period, rather than per decade? The per decade scale works ok for temperature because, even for the 38-yr lower panel, the changes are big enough to not be overwhelmed by internal variability. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure removed from the revised SPM, to shorten it and focus on what matters most to policy-makers. Note that stippling and hatching is no longer shown in the SPM figures (but are included in the chapter figures).
9773	50	0	50	0	the asterisks in the names of the ocean zones on the left (E Pacific) are not explained [Jonathan Lynn, Switzerland]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
90251	50	0	50	0	Figure SPM6: The confidence levels can hardly be seen or differentiated in some smaller areas. In some regions (e.g. CEU, NEU) for the extreme rain both no signal and increase appear and it can be misleading to the policymakers. Do the arrows indicate intensity or frequency? The description says that the arrows indicate the direction of changes in the intensity and likelihood of the events due to anthropogenic climate change. But the next sentence mentions frequency as well. [Bernadett Benko, Hungary]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
86159	50	0	50	0	Figure SPM 6: A summary map like this is potentially very useful for a quick overview of all significant findings. The many tiny icons are however very confusing. The figure could benefit from de-cluttering. – Icons should all be the same size – The icons should always be in the same order as in the legend, and not randomly displayed, e.g. heat wave next to cold wave. – There seem to be only three icons with a mixed signal. Reconsider whether these should be in there at all? Do they add anything useful? And what value do the 'no signal' icons add? Can they not just be removed from this high level overview? Since the stated purpose of this figure is to “show that we now have a lot of evidence” – Confusing to have icons (up/down, H/M/L) inside icons. Suggest having the large icons outlined in red (instead of grey) if it's an increase, and outlined in blue if it's a decrease, for instance. That would get rid of the tiny arrow icons-inside-icons. – Are the region acronyms necessary? A map is a visual item, the IPCC names for the regions don't really matter? It would be less cluttered without them, and they are not defined in the caption. – Avoid pale blue icons, they are hard to see. – Hurricane related flooding icon is too detailed, it could be one large wave onto land. –Sea ice could be blocks of white on dark blue background. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
86161	50	0	50	0	Figure SPM 6: If there is a lack of icons in a region, does that mean no attribution studies were done there, or that there is no discernible signal? This is not totally clear. For example, if there is no hurricane symbol in SEAF does that mean cyclones are not getting more extreme, or that there are no attribution studies? It would be helpful to have this kind of summary map on all significant trends, whether attribution studies have been done or not. Policy makers would like a quick reference that shows whether any of these events are changing in their region or not. [Debra Roberts and the Durban WGII TSU, South Africa]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
86163	50	0	50	0	It would be helpful if all the acronyms in Figure SPM.6 are defined. [Debra Roberts and the Durban WGII TSU, South Africa]	Accepted. This has been added.
15047	50	0			Figure SM 6 is another example of superfluous detail in the Summary. Policymakers' aides seeking this level of detail should consult the main report. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
97485	50	0			This figure provides a useful visual overview of assessed events. We suggest that the icons for the types of events should be less detailed to simplify comprehension. The level of confidence and the signal should be expressed either by colours (or intensity) of by letters/arrows, but not both. Please explain why some regions are empty. [Nicole Wilke, Germany]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
15375	50	1	50	1	"Hurricane activity" should be changed to "Tropical cyclone activity" [Masaki Satoh, Japan]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
8219	50	1	50	1	Many regions have no indicators. Is that because it is not relevant, or it has not been studied. What about marine heatwaves mentioned else where in the report. Where are they in this figure? [Frank Dentener, Italy]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
23403	50	1	50	1	I suspect that this figure could be misinterpreted in the following way: the reader overlooks the "Signal" symbol since it is not so prominent, and look more at the quantity of symbols/type of extreme event and interpret that "Type of extreme event" symbol=attribution. I don't have an easy fix for this, just pointing out what I misinterpreted myself and think that we could get help with from the design team. [Anna Amelia Sörensson, Argentina]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
26245	50	1	50	1	I understand that this Figure might be a draft and that information is still missing. Nevertheless, I would like to point out that no information is shown for the CAM region. Here some of the extreme events that can be found in the region: extreme rainfall, drought, hurricane activity, heat waves, fires, among others (Box SPM.3, Table 1 presents already some info). [Tania Guillén Bolaños, Germany]	Accepted. That information is now displayed in SPM3.
104333	50	1	50	1	Many regions have no indicators. Is that because it is not relevant, or it has not been studied? What about marine heatwaves mentioned else where in the report? Where are they in this figure? [Philippe Tulkens, Belgium]	Noted. To provide simple information figure SPM3 does not contain assessments on changes in ocean extremes as these are assessed very differently to land extremes and would thus have been difficult to display in a single figure. Grey hexagons in the final figure represent regions with limited evidence.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87715	50	1	50	1	Figure SPM.6-Missed information on some extreme aspects over Africa(Please refer to table 11.4) :increase in heavy precipitation,heat waves over SWAF;increase in heat waves over SEAF; [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87717	50	1	50	1	Figure SPM.6- Inconsistencies in level of confidence of increased drought over NEAF and CEAF(low confidence) with table 11.4 (medium confidence) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87719	50	1	50	1	Figure SPM.6 -WAF: inconsistency in increase of heavy precipitation with table 11,4;missing information about heat waves [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87721	50	1	50	1	Figure SPM.6-SAH: Missing information on heat waves (please refer to table 11.4) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87723	50	1	50	1	Figure SPM.6-ARP: Missing information on heat waves (please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87725	50	1	50	1	Figure SPM.6-NEC: Missing information on heat and cold waves (please refer to table 11.9) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87727	50	1	50	1	Figure SPM.6-WSB: Missing information on heat and cold extremes (please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
40367	50	1	50	1	I could not read the text under the water drop icon on the map (e.g., for Europe) I think one says "water" and the other "B...?" Also if I understand correctly, there has been no detectable change in hurricane activity in the Atlantic, no usual heat waves in Greenland or Northern Russia, or changes in the Sahel? [TSU WGI, France]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
87729	50	1	50	1	Figure SPM.6-EEU: Missing information on heat and cold extremes (please refer to table 11.8) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87731	50	1	50	1	Figure SPM.6-ESB: Missing information on heat and cold extremes (please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87733	50	1	50	1	Figure SPM.6-NEA has changed to RFE according to AR6 regions; missing information on heat and cold extremes (please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87735	50	1	50	1	Figure SPM.6-RAR: missing information on heat and cold extremes and precipitation extremes(please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87737	50	1	50	1	Figure SPM.6-SEA: Inconsistency on level of confidence of heat extreme increase with table 11,5 (medium confidence/high confidence)missing information on cold extremes and precipitation extremes(please refer to table 11.5) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87739	50	1	50	1	Figure SPM.6-SEA: Inconsistency on level of confidence of precipitation extreme with table 11,5 (medium confidence/low confidence) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87741	50	1	50	1	Figure SPM.6-GIC: Missing information on heat and cold extremes (Please refer to table 11.8) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87743	50	1	50	1	Figure SPM.6-CAR: Missing information on precipitation extremes (Please refer to table 11.7) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
87745	50	1	50	1	Figure SPM.6-CAM region was divided on 2 regions NCA and SCA (please refer to AR6 regions) (Missing information on heat and cold extremes and precipitation extremes (Please refer to table 11.7) [Wafae BADI, Morocco]	Accepted. This has been changed accordingly.
20939	50	1	50	1	It is not clear why sunshine hours have been categories as an extreme events. We suggest to delete it or provide adequate explanation for it categorization as an extreme event [Ladislaus Chang'a, United Republic of Tanzania]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34561	50	1	50	2	Figure SPM.6 does not convey a clear visual message because so many indicators are packed into a very small space. It might be more effective to have multiple maps, each depicting a subset of indicators (e.g., one for temperature, another for precipitation and storms). [Russell Vose, United States of America]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
105609	50	1	50	2	Could SPM.6 also show marine extreme events? [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. To provide simple information figure SPM3 does not contain assessments on changes in ocean extremes as these are assessed very differently to land extremes and would thus have been difficult to display in a single figure.
54735	50	1	50	2	SPM figures should ideally be clear, self-explanatory and simple. This figure is none of these. If it is to be used, it would be better placed in the underlying TS as most readers of the SPM will have considerable difficulty (correctly) interpreting the contents, and appreciating the caveats. The way the figure is constructed also leaves it open to misinterpretation by those who do not fully understand what event attribution is. For example, a casual reader will see that the figure is about extreme events, and looks at the legend which indicates that upward and downward facing arrows indicate an increasing or decreasing "signal". That casual reader could easily infer that the results are indicating attribution of *trends* in these extremes in various locations (which would be wrong). Likewise, the lack of symbols in some regions could be misinterpreted as a lack of signal (lack or change or trend) rather than what it actually indicates (which is that no event attribution study is available). [Nancy Hamzawi, Canada]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
54737	50	1	50	2	When looking at the underlying support for this figure (primarily Table 11.A.1) there are many entries that appear to be based on a single event (single study) at a single location within the identified region. This is noted in the Figure caption, but there is no way to identify which of the symbols in the figure are based on only a single event versus those based on multiple events. This makes it impossible for the reader to judge the relative robustness of the results, and the extent to which the result is based on a single or multiple events does not seem to be correlated with the level of confidence that is given (in the nearly invisible L, M, H, symbols). [Nancy Hamzawi, Canada]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The data shown is in the final version based on table 11.9 and combines different lines of evidence.
131869	50	1	50	13	Figure SPM.6: I could not find explanation of abbreviations used in the map in the caption. One can only guess those are regions? There might be a need to make symbols larger, I had to zoom in in order to read the icons for signals and confidence levels. You would need to publish this map at least vertically on a single page to get your message out there. [Hans Poertner and WGII TSU, Germany]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
80403	50	1	50	15	According to Figure SPM.6, the SAM region (which mostly corresponds to the southern Amazon) has experienced increased extreme rainfall. Many studies have shown that this region is experiencing a longer dry season and reduced precipitation during the transition from the dry to the wet season, with increased dry-day frequency. This is discussed in CH8, CH10, and Atlas. In fact, SPM3 Table 1 and Figure 1 show increased aridity and drought CIDs for the SAM region [Paola Arias, Colombia]	Accepted. This assessment has been revised to be consistent between chapter 8 & 11.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
96917	50	1	50	15	Fig SPM.6 is missing marine heat waves and other marine-based events, these may be a useful addition as the marine environment is also recording significant event changes now too [Paul Durack, United States of America]	Noted. To provide simple information figure SPM3 does not contain assessments on changes in ocean extremes as these are assessed very differently to land extremes and would thus have been difficult to display in a single figure.
87209	50	1	50	18	This figure is displaying a lot of (useful) information. Could it be flipped to display as landscape in order to make it bigger (and thereby easier to read)? Be aware that the figure gives the impression that the oceans, Antarctic, Greenland and Pacific island will not be affected by extreme events, especially for readers that are not aware that IPCC only assess available scientific literature. Maybe a proper and clearly written caveat somewhere on the figure itself is needed. [Oyvind Christophersen, Norway]	Accepted. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. One intent of the figure is to show where evidence is currently limited. Small Island regions are included in the final version.
131871	50	1			Fig SPM.6 please use climate extremes to align with glossary [Hans Poertner and WGII TSU, Germany]	Noted.
131873	50	1			Fig SPM.6 I dont understand the rationale for including sunshine hours as a climate extreme - if I search chp 11 for this term it only shows in the Appendix Table 11.A.1. Ditto for stagnant air and high pressure. If these stay it might be prudent to add them to the glossary [Hans Poertner and WGII TSU, Germany]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
131875	50	1			Fig SPM.6 marine heat waves are missing from this figure [Hans Poertner and WGII TSU, Germany]	Noted. To provide simple information figure SPM3 does not contain assessments on changes in ocean extremes as these are assessed very differently to land extremes and would thus have been difficult to display in a single figure.
131877	50	1			Fig SPM.6 the arrows show direction of changes in intensity and mixed arrows in frequency and magnitude? Could this be standardised [Hans Poertner and WGII TSU, Germany]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
131879	50	1			Fig SPM.6 the acronyms for regions are not explained anywhere in the referenced material - maybe these could be added to appendix table 11.A.1 [Hans Poertner and WGII TSU, Germany]	Accepted. This has been added.
131881	50	1			Table SPM.1 is only referenced to the headline statement of B5 - not the underlying bullets. [Hans Poertner and WGII TSU, Germany]	Not applicable. The table has been removed from the SPM.
99221	50	3			this is a very dense figure which makes it hard to read. Are there better ways to show the increase in information? Could the text also call out where we have little information resulting in key uncertainties? [Daniela Schmidt, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
50471	50	7	50	8	I'm not sure how to interpret the figure if the annotation is correct when it says 'the location of symbols does not indicate the places of the event occurrence' - presumably it applies to the region/sub-box it sits within though? If so it would be helpful to clarify this. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

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112707	50	50			Figure SPM6 is an excellent additon. It needs to mention in caption that since it is based on observed actual events, it will be biased towards events that become more frequent as those have a better chance of actually occurring, so it is not an assessment of how extremes change, but an attribution of those that recently happened. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
50503	50	SPM6	50	SPM6	The whole figure is a bit complicated. Lots of information crammed into one map. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
100353	50		50		Figure SPM.5: SSA - low confidence in extreme rainfall increase [Claudine Dereczynski, Brazil]	Accepted. This has been revised accordingly.
100355	50		50		Figure SPM.5: SWS - low confidence in drought increase [Claudine Dereczynski, Brazil]	Noted. The assessment refers to agricultural & ecological drought for which ch11 assessed "low agreement" in SWS.
100357	50		50		Figure SPM.5: NES - nothing about drought increase [Claudine Dereczynski, Brazil]	Accepted. Assessment has been revised accordingly.
112925	50		50		I'm struck in this figure by the lack of annotation around what's projected in oceana. Sea level rise, increased flooding, extreme marine heat and extreme precip are some of the challenges. These are extremely vulnerable regions who played a major role in shaping the 1.5C framework. Can we include some acknowledgement that these areas face climate-related challenges? [Kim Cobb, United States of America]	Noted. Figure SPM 3 (former SPM6) is not showing projections but observed changes. Small island states have been included in the final version.
77599	50		50		This figure doesn't indicate time series or time period over which these studies have attributed the framework [Emer Griffin, Ireland]	Accepted. The figure now includes "Type of observed change since the 1950s" on the maps.
18721	50		50		This figure has too much details for SPM. Communication is difficult with this complex figure. I suggest making 4 panels with first panel showing only heat wave, cold wave and fires, second panel showing extreme rainfall, drought and snow storm, thrid showing hurricane activity, hurricane related flooding and sea ice extent and the fourth showing sunshone, stagnant air and high pressure. This segregation could help. [Govindasamy Bala, India]	Noted. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
50473	50		50		Figure SPM6 - does the category 'no signal' mean that attribution studies have been carried out for these types of events but no signal was found, or is this due to a lack of data for attribution of these events. It would be useful to clarify this in the figure caption. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The wording has been revised to "low agreement" and the text changed to: " Striped hexagons (white and light-grey) are used where there is low agreement in the type of change for the region as a whole, and grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole."
7755	50		50		Figure SPM.6: Explanatory text lacks clarity: "The purpose of this figure is to show that we now have a lot of evidence that is attributed to anthropogenic climate change in different regions of the world for many different types of extreme events." Alternative wording is suggested: The purpose of this figure is to show that we now have a lot of evidence that many different types of extreme events can be attributed to anthropogenic climate change in different regions of the world. [Klaus Radunsky, Austria]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
7757	50		50		Figure SPM.6: Figure caption first sentence: The symbols depict types of extreme events for which one or more such events have been studied using the event attribution framework (see Appendix Table 11.A.1). [Klaus Radunsky, Austria]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7759	50		50		Figure SPM.6: Figure caption, second sentence: delete first part ("The location of symbols does not indicate the places of the event occurrence as") because it would only confuse readers. [Klaus Radunsky, Austria]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
7761	50		50		Figure SPM-6: Please, add the explanatiuon for the abbreviations used to characterize the regions [Klaus Radunsky, Austria]	Accepted. This has been added.
104335	50		50		The readability of Figure SPM.6 is low. A better alternative should be to use a gallery-mode of 12 figures showing the global projections of each assessed event, possibly on 2 pages. [Philippe Tulkens, Belgium]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
26003	50		50		In figure SPM.6 it would be useful to know whether areas with no symbols represent areas with no available data. [Don Alfonso Pino Maeso, Spain]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
108211	50		50		SPM.6 Figure is confusing as currently laid out. Use a larger map. What do the boundary lines mean? Figure caption needs a simple, clear caption. [Anton Holland, Canada]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
26039	50		50		FIGURE SPM. 6. The confidence level is hardly seen, perhaps a darker and bigger circle would help. Some reference to the acronyms for the regions would be desirable. [Don Alfonso Pino Maeso, Spain]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54733	50		50		Figure SPM.6: We have a number of concerns about this Figure and don't think this figure is suitable for SPM: 1. The main concern is the figure is prone to misinterpretation. In Ch. 11, this Figure was clearly presented as a summary of available literature on extreme event attribution and was intended to highlight the growing literature on event attribution covering events globally, rather than general attribution of human influence on relevant extremes. By elevating this Figure to the SPM and without providing proper caveats, this figure can easily be perceived as representing general attribution of extremes for the whole region or anywhere within the region. But such an interpretation cannot be supported by the underlying assessment of Chapter 11. 2. It is not possible from the information provided with this Figure to know how to interpret an icon. For example is the icon for fire meant to be interpreted as wildfire intensity or area burned or duration of the fire or is it the weather condition that is prone/conducive to fire? Some icons are not at all readily understood as extreme events (e.g. sunshine hours, high pressure, stagnant air, sea ice extent (declining trend or a specific year's extent?). 3. Even if the icon is understood, there is not a clear and easy interpretation of the map. For example, if the fire icon in NWC is wildfire intensity, then how should the icon in NWC be interpreted? One interpretation could be that there is low confidence that anthropogenic influence has increased the intensity of wildfires in this region (or increased the frequency of wildfires of a given intensity?), but we don't know how many studies this assessment is based on or how broadly such a conclusion would be applicable. Overall it is difficult to understand and interpret this Figure properly without in-depth knowledge of the literature or the subject. Overall, if a figure on attribution is desired in the SPM, it should synthesis the totality of knowledge on attribution, rather than limited to event attribution. [Nancy Hamzawi, Canada]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The data shown is in the final version based on table 11.9 and combines different lines of evidence.
86511	50		50		Figure SPM6 - not easy to understand, please omit. It is better to be covered in Atlas and TS and have a reference to these in SPM [Ala Taimar, Estonia]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
14579	50		50		Wildfire is clearly attributed to climate change? I do not think so. See Ch 12 text [Roshanka Ranasinghe, Netherlands]	Noted. For individual events (which this version of the figure displayed) it is. See chapter 11.8.3.
100351	50		50		Figure SPM.5 is not being called in the text [Claudine Dereczynski, Brazil]	Not applicable. All SPM figures have been renamed and are called in the text.
132417	50				Figure SPM.6: This figure is useful but would need to be combined with evidence on the detection and attribution of trends in weather and climate extremes for higher robustness. [Sonia Seneviratne, Switzerland]	Accepted. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. The final version of fig. SPM.3 (which shows observed changes in extremes and their attribution) is based on a review of the literature of trend attribution as well as event attribution. Regions indicated as "limited evidence" are those for which neither types of attribution studies exist in the published literature. Further, the figure only indicates a trend when this can be detected for the region as a whole. One intent of the figure is to show where evidence is currently limited. Small Island regions are included in the final version.

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1909	50				Raindrops are not teardrop shaped, and so should not be drawn as such. They are oblate spheroids. The drought symbol should also be improved. [Alan Robock, United States of America]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
78993	50				Figure SPM 6 is too complex, we think that it should be strongly simplified. [Martine Vanderstraeten, Belgium]	Accepted. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
17553	50				In regions where there are no symbols, an explanation required as to why this is the case - i.e. no events have been studied, or events have been studied but were not found to be attributable? [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
111009	50				In regions where there are no symbols, is an explanation required as to why this is the case - e.g. no events have been studied, or events have been studied but were not found to be attributable? [Monica Dean, United States of America]	Not applicable. Figure and caption significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown. Grey hexagons are used when there is limited data and/or literature that prevents an assessment of the region as a whole.
131883	51	0			Suggest adding TS cross section box Figure 1 panel a to this SPM figure to help understand how warming evolves [Hans Poertner and WGII TSU, Germany]	Rejected, the intent of the figure is to illustrate that the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ from one driver to another but future CO2 emissions dominate the future total warming.
131885	51	0			a figure connecting scenarios from Special Reports to here would be helpful [Hans Poertner and WGII TSU, Germany]	Rejected for sake of clarity, the intent of the figure is to illustrate that the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ from one driver to another but future CO2 emissions dominate the future total warming.
97487	51	0			Please show gross negative emissions as well. [Nicole Wilke, Germany]	rejected, for sake of conciseness, only the net emissions are shown. The intent of the figure is to illustrate the 5 emissions trajectories used by WG1 and that the future CO2 emissions dominate the future total warming.
130309	51	1	51	1	What are the open circles at the top of the line graph referring to? The explanation in the figure caption needs additional information or the open circles should be deleted. [Trigg Talley, United States of America]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
8221	51	1	51	1	Suggest to include the 0.91 already in figure as it is more policy relevant. [Frank Dentener, Italy]	Not applicable, only one vertical axis remains in the final SPM4 figure.
11401	51	1	51	8	Wouldn't it make sense to list the SSP:s from bottom to top starting with SSP1-1.9? It's more logical to have to lowest value at the bottom and the highest in the top. That would also correspond better with the graph. [Strandberg Gustav, Sweden]	Not applicable, the labelling is done differently in the final SPM4 figure.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54741	51	1	51	21	This is an excellent example of an SPM figure. It conveys highly policy-relevant information in a clear easily understood manner. The only small quibble is with the two vertical axes on the GSAT panel. This may cause confusion, and from a policy-relevance perspective, having a single scale showing temperature change relative to 1850-1900 would avoid any such confusion. The axis showing change relative to 1995-2014 provides additional information that is not essential to the main message this figure conveys. [Nancy Hamzawi, Canada]	Taken into account, only one vertical axis has been kept in the final SPM4 figure.
109221	51	1			Box SPM.2, Fig 1 -- Even after reading full caption, "time to reach warming level" circles are confusing -- perhaps moving them down to the x axis instead would help, or adding an explanation to one (3degC of warming by 2080 in SSP5-8.5). In right panel, consider making medians more salient vs the range -- perhaps dimmer colors in the range and a thicker, full-color bar for median. Consider adding descriptive title, such as "SSPs describe possible future emissions which determine temperature outcomes" (or more accessible language). Also consider changing axis titles and other language to be more general (Temperature in place of GSAT), since precise measures are explained in caption. [Steph Courtney, United States of America]	Taken into account, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming. The readability of the figure has been improved through a design process and a descriptive title has been added.
93781	51	2	51	23	Box SPM.2, Figure 1: please verify the colours of the circles indicating the times when 1.5°C is reached, the order seems incorrect and there should be no light green circle (standing for SSP1-1.9) among them [Quentin Lejeune, Germany]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
80115	51	3	51	3	Figure: Some description is needed for the left figure on the top part (Warming levels of scenarios relative to 1850-1900) and a timeline should be here too. Also, why 2021-40 figure part is missing from the right plot? [Lilian Fejes, Hungary]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
34563	51	3	51	4	Figure SPM.7 works really well. My compliments to the developer. [Russell Vose, United States of America]	Thank you
50517	51	3	51	4	In the left panel, please provide measures of uncertainty in the emissions compatible with the radiative forcing levels of 1.0, 2.6, 4.5, 6.0 and 8.5 Wm ⁻² by 2100 (this would be expected to be similar to AR5 WG1 Chapter 6 Figure 6.25). [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this figure illustrates the 5 scenario used in the core CMIP6 simulations (which are the basis for the WG1 assessment). The ranges of scenarios compatible with each radiative forcing pathway are assessed in the WG3 report.
32367	51	3	51	4	Why is 1.5°C warming reached latest by SSP3-7.0 in the left panel, while in the right panel it seems that the temperature increase follows nicely the expected SSP order? [Clemens Schwingshackl, Norway]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
37811	51	3	51	4	In the picture on the right, unlike other scenarios, median was not shown only in SSP1-1.9. Please check it. [Junhee Lee, Republic of Korea]	Taken into account, all the medians are shown in the final SPM4 figure.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
80117	51	5	51	11	The figure contains “emissions as inputs” as well and as such it should be included in the text as connecting with scenarios. These 4 lines are not needed but it is slightly a better summary for the figure than the first actual sentence in the figure description, so it could be changed for that. [Lilian Fejes, Hungary]	Not applicable, these sentences were only there for SOD version because the figure was still in its design process.
80119	51	11	51	20	The figure description could be shortened and made more clear: 1) line 11: CO2 emissions are coming from many sources and not just these two mentioned here so they could be removed. 2) not explained why only two time periods are shown. 3) line 14: It is claimed that not raw outputs were used for the figure, but it always was the polynomial signals used elsewhere too so this could be omitted then. 4) line 16: the method explaining the best estimate for reaching certain warming levels is a repetition from the SPM Box.2 text, it can be omitted. 5) line 19: not clear what the best estimate mean here, the mean signal 6) line 20: the uncertainty ranges should not be placed on the warming levels, it would be too much detailed, this can be omitted from the text then. [Lilian Fejes, Hungary]	Not applicable, the caption has been fully rewritten.
50475	51	14	51	15	Figure 1 Box SPM2: It would be useful to explain how much of this plot showing projected temperature change under different SSPs is derived from models, and how much other lines of evidence. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the various lines of evidence have been clarified in the caption of figure SPM4 panel b.
50477	51		51		Box SPM2 Figure 1: Would it be possible to add a year timescale to the top horizontal line of the left hand plot (CO2 emissions per year) - it's currently quite difficult to see where the timing of temperature levels are projected to be reached under the different SSPs. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this information has been removed from the final figure to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ from one driver to another but future CO2 emissions dominate the future total warming.
131887	51		51		What I'm I supposed to learn from the smaller graphic on the right? A written key finding or key message would really help here. [Hans Poertner and WGII TSU, Germany]	Taken into account, the intent of the figure is now clarifier on top of the final figure SPM4 and the right panel is bigger and has been made more readable through design process.
7763	51		51		BOX SPM.2, FIGURE 1: Explanatory text should be modified: The purpose of this figure is to connect scenarios, scenario-based projections and warming levels. The figure is providing a visual link between SSPs, annual CO2 emissions, the assessed GSAT ranges for SSP scenarios for the medium (2041-2060) and long term (2081-2100) and the time periods at which the specific warming levels are reached. [Klaus Radunsky, Austria]	Not applicable, these sentences were only there for SOD version because the figure was still in its design process.
7765	51		51		It is suggested to split the figure caption in a description for the left figure (BOX SPM.2, FIGURE 1a) and a description for the right figure (BOX SPM.2, FIGURE 1b). [Klaus Radunsky, Austria]	Taken into account and done in the final version of the SPM.
7767	51		51		BOX SPM.2, FIGURE 1, figure caption: Suggested text for the left figure: Figure 1a shows the time series of SSP-based annual CO2 emissions from fossil fuel combustion and land use change for the core set of five illustrative SSP scenarios used in this report as well as along the top axis, with circles under each warming level indicating best estimates for the individual scenarios, the time by when particular warming levels relative to 1850-1900 are reached in the SSPs. [Klaus Radunsky, Austria]	Not applicable, the caption has been totally rewritten for the final version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7769	51		51		BOX SPM.2, FIGURE 1, figure caption: Suggested text for the right figure: Figure 1b shows SSP based temperature projections for the medium term (2041-2060) and long term (2081 to 2100). Note that the projected changes in GSAT are not based on raw model outputs, but on multiple and converging lines of evidence that enable the narrowing of the range of possible temperature outcomes. Adding 0.91°C to the best estimate and the ranges for selected time periods provides an approximation to the 1850-1900 baseline (see Box TS.4, Table 1). [Klaus Radunsky, Austria]	Not applicable, the caption has been totally rewritten for the final version.
9573	51		51		Probably the most important figure of the SPM. Need to plot current emission trajectory based on Nationally Determined Contributions (NDCs) to highlight the gulf between current policy and scientific reality. This figure should illustrate how far away we are from achieving Paris Agreement targets and the level of global warming we are likely to achieve given weak global emission reduction policy. This figure should serve as a very strong motivator for increasing ambition to reduce emissions. If not, we are looking at warming most likely in the range of SSP2-4.4 or SSP 3-7.0. Need to carefully communicate SSP5-8.5 as that level of warming is catastrophic (as are the 'middle of the road' scenarios). Summary text needs to specific comment on the paris Agreement targets i.e.. virtual impossibility of achiving 1.5C and clearly state the realistic liklihood of when 2C will be reached. [Joelle Joelle Gergis, Australia]	Rejected, the mandate of WG1 does not include the assessment of plausibility or feasibility of the scenarios. These aspects are in the scope of the WG3 assessment report..
26041	51		51		BOX SPM.2, FIGURE 1. For the left graph, please also add x-axis labels in the upper part for easier comparison with warming levels. Perhaps, instead of a circle for the warming level a solid point would help to differentiate colours. For the right graph [Don Alfonso Pino Maeso, Spain]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
109505	51		51		If the left panel of Box SPM.2 Figure 1 shows emissions compatible with the CO2 concentrations used to drive the CMIP6 concentration-driven projections, would have expected to see uncertainties in the compatible emissions pathways here (as was shown in SR15 for the 1.5-compatible scenarios). I think it will be important for readers to see the uncertainties in, for example, the dates for emissons reaching net zero in SSP1-1.9 and SSP1-2.6. Also Figure SPM.7 shows uncertainties in the land and ocean carbon fluxes which clearly illustrate uncertainties in the carbon cycle which are currently not being shown in this figure. [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, this figure illustrates the 5 scenario used in the core CMIP6 simulations (which are the basis for the WG1 assessment). The ranges of scenarios compatible with each radiative forcing pathway are assessed in the WG3 report.
109511	51		51		I suggest that an additional panel showing the CO2 concentrations used as input to the models should be included here. This would help readers to understand why SSP1-19 still shows 0.5 - 1.1C warming in 2041-2060 relative to 1995-2014 even though the left panel shows global emissions reaching net zero shortly after 2050. [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Rejected for sake of conciseness. The intent of the figure is to illustrate the 5 emissions trajectories used by WG1 and that the future CO2 emissions dominate the future total warming.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54739	51		51		Box SPM.2 Figure 1: This is a very good figure and we strongly support its inclusion in the SPM. For clarity, it might work better to put the information about the time when different levels of global warming are surpassed under the x-axis so it's clearer what those time intervals are. [Nancy Hamzawi, Canada]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
86513	51		51		BOX SPM.2, FIGURE 1 - could be included within the condensed BOX SPM2 or separately. The scenario names here and in the text are not helpful and could be replaced with new ones that help the reader to understand what these are about. [Ala Taimar, Estonia]	Rejected, the names of the scenarios have been defined and used widely in the scientific literature. For sake of traceability we follow the same terminology.
14581	51		51		It takes quite some effort to figure out what the horizontal bars on top of the left panel and the circles along those bars actually show and to make the connection between the warming levels and the scenarios. Would there be a more easily understandable format for this figure? Sorry I don't really have an alternative suggestion at this point. [Roshanka Ranasinghe, Netherlands]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
81435	51				BOX SPM.2 Figure 1 This is a very important figure. I suggest it could be simplified by only showing temperatures relative to 1850-1900. Also, the attempt to show when various threshold are reached by putting the numbers with bars along the top of the left hand diagram is useful but not easy to read. An alternative would be to add dotted lines on the diagram going through the points on the emission curves when the temperature threshold is reached. [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the information about crossing-time has been removed from the final figure to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
111709	51				Box SPM.2 Fig 1. This is another nice figure that packs in a lot of information, so it's important to make it as easy to follow as possible (ideally for presentations, without having to read the caption). Suggestions: Place the RH panel beneath the LH panel and line up the timescales. You could then consider including a third period in the GST panel (2061-2080) It would be a very informative reference if the emissions panel could also include a line showing the current rate of emissions growth from 2015 Suggest for the GSAT panel, put the warming relative to 1850-1900 as the left axis, as this is the most policy-relevant for this figure. If you also want to show change relative to a near-present temperature (on the right axis), please make this reference period consistent across the SPM (see my comment on the whole SPM regarding reference periods) [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account in the design process of the final SPM4 figure.
17555	51				This is a helpful figure, but for absolute clarity, caption or other text for the left hand graphic needs to explain how the different warming levels (1.5, 2.0 etc.) link to the scenarios. To a non-specialist it is clear after some reflection, but not immediately obvious. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
111015	51				This is a helpful figure, but for absolute clarity, caption or other text for the left hand graphic needs to explain how the different warming levels (1.5, 2.0 etc.) link to the scenarios. To a non-specialist it is clear after some reflection, but not immediately obvious. [Monica Dean, United States of America]	Not applicable, the information about crossing-time has been removed from the final figure SPM4 to give more prominence to the intent of the figure: the 5 trajectories assessed by WG1 rely on a wide range of emissions trajectories and the emission pathways differ for one driver to another but future CO2 emissions dominate the future total warming.
9643	51				Are the bars 90% range? If the results are not raw model outputs but ranges of possible temperature outcomes, then I would strongly advocate for showing 2050 and 2100 temperature levels rather than T change for 2041-2060 and 2081-2100 (with the latter being significantly less than 2100 temperature change for the high end scenarios). Isn't what policymakers would be interested in? [Olivier Boucher, France]	Taken into account, the definition of the range is clarified in the caption. The 20 year means have been kept to be consistent with the other figures and Tables shown in the SPM.
82539	52	0			No sources are quoted for the observational data sets in Figure SPM.7 (or in the TS figure that the caption references). [Blair Trewin, Australia]	Taken into account. Observations have been removed.
97489	52	0			Climate change information from climate projections for the period 2021-2040 should not be shown in favour of INITIALIZED decadal climate predictions. In the lifetime of IPCC AR6 almost half of this period will have passed. Please revise. [Nicole Wilke, Germany]	Rejected. Showing initialized predictions would go well beyond the intent of this figure. Initialized predictions are shown in the underlying chapter.
97491	52	0			Figure SPM.7, panels a, b, d, e, f: from a climate service point of view it is unfavourable to change the reference period from one report to the next and even within reports to show climate change. As a result the IPCC figures cannot be used directly by many users including weather services and environmental agencies but have to be redone. Please see also our comment on the Entire Report regarding _reference periods. [Nicole Wilke, Germany]	Rejected. The choice of this particular reference period has been well thought out.
77575	52	1	52	1	What does the horizontal dashed line represent in the September Arctic Sea Ice figure of SPM.7? Is it "one 10^6 km^2"? [Emer Griffin, Ireland]	Taken into account. Annotation has been added.
76863	52	1	52	1	Figure SPM7: Using a 1995-2014 reference level is going to add confusion relative to previous reports including the recent SROCC report. E.g it will appear that sea level rise estimates have decreased. Strongly suggest sticking with 1986-2005 reference interval for quantifying future changes so that results are easily comparable between reports. Panel c, consider using % change rather than absolute values due to the large differences in the amount of sea ice between models. Panel e, is there really a need to include the extra thermosteric lines - regular people and policy makers are interested in how much sea level will rise, not how much comes from different components. Panel f doesn't work in the current layout, but the lessons learned from SROCC are that policy makers will want this information in an SPM figure (see SROCC SPM1 for the solution that we came to there - and good luck!). I'm not sure that panels g and h fit on this figure. Perhaps a separate carbon cycle figure is needed, or else express in terms of the changes these will cause and that people and ecosystems will be affected by (i.e. show ocean pH instead of flux of carbon from the atmosphere to ocean). [Nerilie Abram, Australia]	Taken into account. 1) The reference period has been well thought out. Changing it here and in all of the underlying chapters is out of the question at this stage. 2) See no value in displaying % over absolute changes. 3) Thermosteric SLR is no longer displayed. 4) Carbon flux panel has been removed. pH is shown instead.
17743	52	1	52	1	It is not clear what "Historical" represent. [Anette Jönsson, Sweden]	Taken into account. Made clearer now in the caption.
79955	52	1	52	1	Figure SPM.7. Very clear intent and content in this figure, which will be widely used by policy makers. One suggestion would be to better integrate (visually) the symbols used for each row. Currently it is not entirely clear that these apply to both the left and right panels of each row. [Eamon Haughey, Ireland]	Taken into account. Symbols have been deleted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
37723	52	1	52	1	The use of a little windy cloud is not intuitive to mean temperature and precipitation. It might be good to find something different, maybe a thermometer and a little droplet? Otherwise, are those little symbols necessary? [Stephanie Arcusa, United States of America]	Taken into account. Symbols have been deleted.
23405	52	1	52	1	Figure SPM.7c: What does the dashed line stands for? [Anna Amelia Sörensson, Argentina]	Taken into account. Now annotated.
10227	52	1	52	1	confusing/cluttering to show thermosteric sea level change on same axes as GMSL change? [Robert Kopp, United States of America]	Taken into account. The former is no longer displayed.
77563	52	1	52	1	Why is the uncertainty shading excluded for certain SSPs? For example, surface temperature SSP2-4.5. Perhaps the reason (readability?) should be made clear? [Emer Griffin, Ireland]	Taken in account. In order to avoid overlapping shading.
34565	52	1	52	2	Figure SPM.8 is good, but the icons on the left are not intuitive. [Russell Vose, United States of America]	Taken into account. Icons have been removed.
131889	52	1	52	2	I am not convinced by the icons in Figure SPM.7. A cloud might work for precipitation change but not for temperature change. The wave symbol doesn't really indicate sea level rise, and the flux symbol with the waterline underneath might work for atmosph to ocean carbon flux (g) but seems strange as icon for the atmosph to land carbon flux (h). It is not clear what is the value of the symbols (which look like wind, ice, tsunami and flux) - if there is a purpose for these and if so could these be standardised with the symbols in SROCC [Hans Poertner and WGII TSU, Germany]	Taken into account. Carbon fluxes are no longer displayed.
105611	52	1	52	2	Not sure about the icons on the left hand side. Carbon cycle icon seems to indicate "wash on a gentle cycle and dry flat" ;-) [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Symbols have been deleted.
54745	52	1	52	16	In general, this figure is clear and approachable for the intended audience, however the choice of showing GSAT projections based on multiple lines of evidence only (and not showing the model-based results as for all the other panels) is potentially a source of confusion, particularly since interannual variability disappears (and so may give the misleading impression that variability will be absent or unimportant in the future). It is strongly urged that the raw model results be shown, and the refined values based on additional lines of evidence be overlain in some way so as to retain consistency with other panels in the figure and avoid the potential misunderstanding noted above. [Nancy Hamzawi, Canada]	Rejected. Here we are presenting the latest literature which here involves multiple lines of evidence for GSAT and GMSL.
80131	52	1	52	17	The figure and the description could be improved in the following way and the figure could be slightly bigger: 1) No ranges are shown for the 1.9, 4.5 and 7.0 scenarios. It could be explained why not and why they are for the others. 2) What is the reason fig. f. is needed? It is beyond timeline scope and only RCPs are applied and not SSPs (like in other figures). 3) On fig. a. "(assessed)" is not needed, while on fig. d. "change" should be used instead of "extent". 4) In the description: GSAT is defined as surface temperature, so near can be erased from here. Furthermore the note at the end of the description is too mystical. Is not it the polynomial fits (signal separated from noise) used instead of raw outputs? What about the sea level change? It looks it was made with well-fitted lines and ranges. [Lilian Fejes, Hungary]	Taken into account. All of these comments have been taken into account in the figure and the caption.
87031	52	1	52	17	Figure SPM.7 Important figure. Please consider to make a proper figure title and move the purpose paragraph up before the figure itself. [Oyvind Christophersen, Norway]	Accepted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
78599	52	1			check units on the carbon flux panels – the labelled units of GtCO ₂ are incorrect – it is GtC plotted. Also caption has incorrect labelling for panels (g) (h). [Chris Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Carbon fluxes are no longer displayed.
109223	52	1			SPM.7 -- If so many graphs are going to be shown together, consider making each simpler to illustrate big ideas -- for example, show only historical or observed (or a single combined metric), and only 2-3 SSPs each. Or, keep 4-5 SSPs but omit uncertainty, since near/mid/long-term already uses shading as a visual tool. Much more minor, consider a simpler or combined icon for temp/precip row (such as thermometer, or thermometer + raindrop) [Steph Courtney, United States of America]	Taken into account. 1) We have tried to simplify the information in the FGD. 2) The symbols have been removed.
97493	52	4	52	4	Fig SPM.7: What is the uncertainty range depicted in this figure? From the AR5, WG I, S 1040, Ch. 12.2.3. it is clear that the model spread must not be confused with uncertainty. [Nicole Wilke, Germany]	Accepted. The uncertainty ranges are explained in the caption.
109501	52	4	52	5	I thought the CMIP6 projections were concentration-driven as opposed to emissions-driven (as far as CO ₂ is concerned anyway) so describing them as "climate futures associated with different emissions scenarios" is not correct. In particular, the shading showing intermodel spread does not capture the true uncertainty in the climate response to emissions as it ignores the uncertainty in carbon cycle feedbacks. Please make this clear here. [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The phrase "emissions-driven" has been removed.
17745	52	9	52	16	Since the Figure show changes it is good to mention the reference period from which the changes originate. [Anette Jönsson, Sweden]	Accepted. The reference periods are described in the caption.
69459	52	9	52	16	"(f)" is used two times in the caption of Figure SPM.7, and the descriptions for (f) and (g) do not match the corresponding Figures. [Kaoru Magosaki, Japan]	Accepted. Corrected.
39089	52	9	52	17	Comment regarding Figure SPM7, panel e. I assume the values for total 2100 should be the same as in Box SPM.2, Table 2. But SSP1-2.6 does not seem to be 0.47, but lower. Also, these values seem to be the same as for years 2081-2100 in Table 4.5. This needs to be checked for consistence. Would prefer to have this panel without the partition for Thermosteric, which is never mentioned in the SPM text and only add to confusion in the figure. [Ola Kalen, Sweden]	Taken into account. This panel has been completed redone using GMSL values from Chapter 9. The thermosteric component has been removed.
66501	52	9	52	17	It's really hard to distinguish between the shading used for the near-term/mid-term timeperiods and the shading used for uncertainty in some of these panels (h in particular) [Charles Koven, United States of America]	Accepted. This has been improved.
81921	52	13	52	13	Be explicit if "ocean carbon sink" includes coastal sinks such as mangroves, saltmarsh and seagrass ("blue carbon")? Are these coastal wetland sinks captured under "ocean" or "land" or are they absent? [Dan Zwart, New Zealand]	Taken into account. The carbon flux panel has been removed.
64801	52	13	52	13	(f) Annual ocean carbon sink and (g) Annual land carbon sink should be revised to "(g) and (h)" respectively [Casey Kopcho, United States of America]	Taken into account. The carbon flux panel has been removed.
50531	52	13	52	13	Please insert "net" after "annual" for both "annual ocean carbon sink" and "annual land carbon sink" [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The carbon flux panel has been removed.
77565	52	13	52	13	"(f) Annual ocean carbon sink, (g) Annual land carbon sink" should read "(g) Annual ocean carbon sink, (h) Annual land carbon sink" [Emer Griffin, Ireland]	Taken into account. The carbon flux panel has been removed.
50479	52	SPM7	52	SPM7	Could we put the 'relative to 1995-2014' on RH y axis and 'relative to 1850-1900' on LH y-axis (as the latter is more relevant to UNFCCC)? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. This would then be incompatible with the other panels.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112927	52		52		I don't know where it belongs, but I really hope that we might include some graph illustrating CO2 concentrations. Where we've been, where we're going, in the SPM. I am struck that one cannot find such a plot in the report, outside Chapter 1. Shouldn't it be included at the very least in Ch5? I will comment as much, but I do think it belongs somewhere in the SPM, as most people do not think in terms of integrated emissions. [Kim Cobb, United States of America]	Accepted. These are now shown in figure SPM.4 of the FGD.
18729	52		52		Fig. SPM7 panels g and h: "CO2" could be written at the center for the left most logo for these two panels. [Govindasamy Bala, India]	Taken into account. These quantities are no longer displayed.
7771	52		52		Figure SPM.2: Overall, figure is ok. However, there is need for some further explanations, e.g. in the figure caption. Such further explanation should address an explanation of the term "historical" and the term "Observations"; why in the figure informing about the Annual Global sea level beyond 2100 the dependence on RCPs is used but not on SSPs. Furthermore, if assessments are only available for these RCPs they should be described correctly (RCP2.6, RCP4.5 and RCP8.5 [Klaus Radunsky, Austria]	Taken into account. 1) Caption has been improved. 2) GMSL is now shown at 2300. 3) Only SSPs are displayed in the FGD.
50525	52		52		The italicised text under Figure SPM.7 states that this presents projections based on emission scenarios, but the figure appears to be drawn from information in other chapters in which the models are driven by pathways of GHG concentrations rather than emissions. Please clarify whether these projections are from emissions scenarios or concentration pathways. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Emissions are no longer referred to.
50527	52		52		Figure SPM.7 (g) and (h) - these are from Chapter 4 Figure 4.5 (a) and (b) but different units are used on the y-axis (GtCO2 in SPM.7 and PgC in 4.5). However, the magnitude of the change in the fluxes are the same, even though one would expect the values in the figure in SPM7 to be larger by 44/12. If different units are to be used in the SPM and chapters, please check that all numbers presented in PgC in the chapters and GtCO2 in the SPM have been converted correctly. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The carbon flux panels are no longer shown.
50529	52		52		Figure SPM.7 (g) and (h) present carbon fluxes in GtCO2 but Chapters 4 and 5 use PgC. Please be consistent or provide a guide to conversion between the units. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The carbon flux panels are no longer shown.
104337	52		52		Panel h of figure SPM-7: the strong reduction of annual land carbon sink in SSP1-1.9 should be explained to help policy makers understand the mechanisms behind and the CDR methods implied. [Philippe Tulkens, Belgium]	Taken into account. Carbon fluxes are no longer displayed.
108213	52		52		SPM.7 Good use of icons here. Graphs are clear and present a direct message. [Anton Holland, Canada]	Accepted.
109503	52		52		In panels g and h of Figure SPM.7 I think the units should be GtC not GtCO2? [Richard Betts, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. These quantities are no longer displayed.
54743	52		52		Figure SPM.7: Will shading be added to the observational time periods to indicate uncertainty? [Nancy Hamzawi, Canada]	Rejected. Will feel no advantage to shading the reference period.
5093	52		52		Figure SPM.7: It is difficult to interpret a figure with different future projection (CMIP5 vs. CMIP6). If (f) could be created based on CMIP6 data that should be done. In case the required data is unavailable the color scale of the scenarios should be the same. Currently light blue is used in (f) for RCP4.5 and in all others figures for SSP119. [Martina Stockhause, Germany]	Taken in account. The figure now only displayed SSP information.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
132007	52		55		Several figures are not clear whether they relate to changes in GSAT or GMST. They are also not clear whether the 1.5 is the 1.5 of the Paris agreement or not or how it compares. [Hans Poertner and WGII TSU, Germany]	Not applicable. 1) Following the SOD review, changes in GSAT and GMST were assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Additionally, all the data used in the SPM figures are openly accessible https://catalogue.ceda.ac.uk/uuid/ae4f1eb6fce24adcb92ddca1a7838a5c along with their metadata 2) Re. the baseline, all warming levels in the SPM are expressed compared to the 1850-1900 baseline.
81437	52				Figure SPM.7 Why is RCP70 omitted from f) but not from the other diagrams? [David Warrilow, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Figure SPM.8 now only shows SSP scenarios, not RCPs. Panel e only includes SSP1-2.6 and SSP5-8.5 because those are the only projections available for 2300
112709	52				SPM 7 nice figure, I am not sure about the value of global land rprecipitation change. If it's a physics test, then all precipitation (but that loses the obs) or why not high latitude precipitation which isn't a cancellation of increases and decreases? Or global heavy pcp? [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This quantities is no longer displayed.
111711	52				Fig SPM.7f. There will be a lot of interest to also see SSP1.9 and 7.0, if extension scenarios are available. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. These extensions are unavailable.
9645	52				I find it confusing and difficult to justify that the GSAT curves and the other curves do not correspond to the same methodology. [Olivier Boucher, France]	Rejected. The literature supports multiple lines of evidence only for GSAT and GMSL.
86165	53	0	53	0	Suggest removing "Tglob anomaly" from the figure, and leave only the degrees, defined in the legend. – What do the numbers 20, 20, 12 or 103, 93, 30, etc. refer to ? [Debra Roberts and the Durban WGII TSU, South Africa]	Taken into account. Panels, captions and intents have been substantially revised.
90261	53	0	54	0	Figure SPM8: The acronyms might not be needed next to the figure names (CDD, TXx, etc.) The meaning of the numbers next to each small figure e.g. 103, 93, 30 are unclear. Relative anomaly or temperature anomaly are not needed on the scale as it is in the title, simply %, days and °C could be enough. [Bernadett Benko, Hungary]	Not applicable. Panels for TXx and CDD are not shown in final version.
15049	53	0			Figure SPM 8 is another example of too much detail in the Summary. Policymakers science advisors seeking this level of detail should consult the main report. [Fredric Taylor, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The number of panel has been substantially reduced.
97495	53	0			Since the current NDCs will lead to a global warming of about 3°C, please add a respective panel. [Nicole Wilke, Germany]	Rejected. This information is available in Atlas and chapter but space in SPM is limited

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
97497	53	0			Figure SPM.8, figure caption: Please add information on the meaning of the number next to each panel /map (upper right corner). [Nicole Wilke, Germany]	Not applicable. Number of models is no longer shown in final figure.
130311	53	1	53	1	What are the numbers next to the map images referring to? For example, the maps under the "consecutive dry days anomaly" have 103, 93, 30 (left to right). Please provide an explanation. [Trigg Talley, United States of America]	Not applicable. Number of models is no longer shown in final figure.
54747	53	1	53	1	given that the units of the bottom row of the figure are the same as in the preceding two rows (anomaly in %) it is not at all obvious why a difference color bar is used. This is potentially confusing. [Nancy Hamzawi, Canada]	Taken into account. Panels and colour bars have been substantially revised.
107793	53	1	53	3	SPM.8 : just as you did it for the annual temperature anomaly, could it be possible that you provide a global map for the sea level change ? [FREDERIC MENARD, France]	Rejected. This has not been added due to space limitations.
20941	53	1	53	3	characterization of "Annual Maximum Daily Rainfall Anomaly" is confusing. It is not clear what is computed [Ladislaus Chang, United Republic of Tanzania]	Not applicable. Panels have been removed.
93783	53	1	53	12	This figure SPM.8 is very useful. To make it even more policy-relevant, would it be possible to include changes at 3°C (corresponding approximately to the amount of global warming that would be reached in 2100 if current NDCs are implemented or current policies are maintained), instead of changes at 4°C or in addition to the other panels? Moreover, please consider the inclusion of a stippling or hatching to indicate statistically significant changes. [Quentin Lejeune, Germany]	Rejected. This information is available in Atlas and chapter but space in SPM is limited
131891	53	1	54	10	Figure SPM.8. It was hard for me to figure out the following (this information is missing/not clear in the caption too): 1. What do numbers on the top right corner of each three anomaly maps indicate? 2. In terms of precipitation anomalies what does the scale mean, e.g. -40% (brown) does it mean that less anomaly, or less precipitation relative to zero? 3. The same in terms of consecutive dry days anomaly. I think a layman would not understand the figure in this form. My suggestion to add information that the "figure highlights the following findings: XXX" [Hans Poertner and WGII TSU, Germany]	Taken into account. Panels, captions and intents have been substantially revised.
87211	53	1	54	12	It would be useful to explain what is meant by an 'anomaly' here, especially for a non-expert reader. In addition, given all the different notions and abbreviations in subtitles, you are making it very hard for the readers to actually understand the purpose with the figure. Please consider to move the purpose paragraph up before the figure itself. [Oyvind Christophersen, Norway]	Taken into account. Panels, captions and intents have been substantially revised.
130313	53	1			[ENSEMBLES] Is this figure derived from raw model output, including the output that was not used for GSAT? If so, there is an inherent contradiction with SPM.7(a), which researchers might use to relate these changes to prospective global mean surface air temperature changes. [Trigg Talley, United States of America]	Rejected. There is not contradiction as the information is shown for levels of warming. How information can be translated between GWLs and SSPs is detailed in the TS and cross-chapter Box11.1
77569	53	2	53	2	Experience shows that the large projected increases of precipitation over the dry regions of North Africa & the Middle East are usually due to very small changes but "appear" very large when a percentage change metric is used. It is understood that a different metric is not suitable (doesn't provide a feeling of change and wet areas dominate the figures) but perhaps this issue (if it exists) could be qualified here? [Emer Griffin, Ireland]	Taken into account. This has been annotated in the final SPM version.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
34567	53	2	53	3	The maps on Figure SPM.9 work well enough, although they would be a bit more readable if there were one or two fewer categories on each scale. More important is that the map titles are not intuitive. For example, is the 'annual mean temperature anomaly' the difference between the annual mean temperature of today and the annual mean once the globe has warmed 1.5C? Similarly, is the 'annual exceedance of warmest daytime temperature' the difference between the number of days over 35C at present vs. once the globe has warmed 1.5C? I also noticed that the map titles are not consistent with the ETCCDI Index names in parentheses. Finally, what are the numbers in the upper right-hand corner of each map? [Russell Vose, United States of America]	Taken into account. Panels, captions and intents have been substantially revised.
67695	53	2	54	10	What is meant by a numeral located on the right shoulder of each small figures? For example, 118, 106, and 34 are written at the top three figures. [Hiroaki Kondo, Japan]	Not applicable. Number of models is no longer shown in final figure.
50481	53	SPM8	53	SPM8	Are these maps of projected change from CMIP6 models? Please specify in caption. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Panels, captions and intents have been substantially revised.
9575	53		53		Unclear what the little numbers in the top right of each figure refers to? Include an explanation in the caption. [Joelle Joelle Gergis, Australia]	Not applicable. Number of models is no longer shown in final figure.
26005	53		53		In figure SPM.8, please explain the meaning of the number that appears on the right top corner of each map (118,103,34,...). Again, maps are too small to clearly see the information. [Don Alfonso Pino Maeso, Spain]	Not applicable. Number of models is no longer shown in final figure.
116137	53		53		Figure SPM 8, chapter 4 placed an emphasis on heat stress, but it is not represented here, could it be considered too given its relevance? [Valerie Masson-Delmotte, France]	Rejected. Due to limited space a panel on heat stress was not included.
108215	53		53		SPM.3 A much easier to understand visualization is required here. [Anton Holland, Canada]	Taken into account. Panels, captions and intents have been substantially revised.
100349	53		53		Figure SPM.8 - It should have the same hatchings in the maps, as it is used at Atlas, to show uncertainty. [Claudine Dereczynski, Brazil]	Rejected. The maps are too small to add hatching.
7773	53		54		Figure SPM.8: It is suggested to substitute the current figure SPM.8 by the original figure TS Cross-Section Box 2 Figure 1, including the description of the figure, because the original figure is much more informative. It also does not include somehow mysterious numbers (e.g. 118, 106, 34 for annual mean temperature anomaly. [Klaus Radunsky, Austria]	Taken into account. Panels, captions and intents have been substantially revised.
111713	53				Fig. SPM.8. Is there any way to show current or pre-industrial (T _{anom} = 0C) values for TX days>35C and CDD? I imagine readers wn't be familiar with these reference values. [Richard Wood, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Panels are not shown in revised figure.
107959	53				fig spm-8: suggest the first precip row is labelled "annual mean precipitation anomaly" (i.e. drop "daily") so it is equivalent to the top row which says "annual mean temperature anomaly" (i.e. doesn't mention "daily" temperature) -- since the units are relative anomaly (%) then it doesn't matter if this is based on daily, monthly or annual totals, the map is the same. Including "daily" is just confusing, the reader may think this is related to daily intensity or something. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Panels, captions and intents have been substantially revised.
107961	53				fig spm-8: maybe change all the words "anomaly" to "change", i.e. temperature change, precipitation change, relative change. "anomaly" is unnecessarily jargon [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Panels, captions and intents have been substantially revised.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130315	54	5	54	1	Please define the acronym "TXx" used in Figure SPM.8. First, it is unclear what the additional "x" refers to. Second, other acronyms have been defined in this caption except TXx. [Trigg Talley, United States of America]	Not applicable. Corresponding panels have been removed.
78669	54	5	54	5	In figure SPM.8, what is the meaning of the numbers in the upper right corner of each panel (118, 106, 34, ...)? Either explain or remove. [Heike Wex, Germany]	Not applicable. Number of models is no longer shown in final figure.
108569	54	5	54	6	What are the numbers in the upper right corner of these map-graphs? [Jason Donev, Canada]	Not applicable. Number of models is no longer shown in final figure.
108571	54	5	54	6	The first six maps make no sense, can this please be explained more clearly? [Jason Donev, Canada]	Taken into account. Panels, captions and intents have been substantially revised.
18727	54	6	54	6	"daytime temperature of annual warmest day" Is the daytime-mean temperature temperature on the warmest day in a year is referred to here? Or the maximum daytime temperature? This may be clarified. Normally we see changes in daily Tmax discussed in the literature. [Govindasamy Bala, India]	Taken into account. Panels, captions and intents have been substantially revised.
90257	55	0	55	0	Figure SPM9: The meaning of the y-axes on the left (between different 30-year periods) are not sophisticated/clear enough. The meaning of all scatter points are not clear either. [Bernadett Benko, Hungary]	Considered. Fig SPM.9 is redesigned and its caption is also rewritten to make the figure and caption less technical.
131893	55	0			In Figure SPM.9, I am wondering whether "waiting time" is really the best wording here. When I hear "waiting time" I intuitively think "the shorter - the better", which I guess is not what you want to communicate here. [Hans Poertner and WGII TSU, Germany]	Considered. The figure is redesigned and the new design does not use "waiting time".
131895	55	0			Fig SPM 9 - a and C - does this mean the magnitude (size) of the extreme is up to 7% and 30% bigger under SSP5? The figure caption is not intuitive 'global land median changes in the 50-year return values of....' [Hans Poertner and WGII TSU, Germany]	Considered. The figure is redesigned and caption is rewritten.
131897	55	0			Fig SPM 9 - b and d - is this projected changes from observed 10-year and 50-year events? Consider labelling on the graphs [Hans Poertner and WGII TSU, Germany]	Considered. The figure is redesigned to make these aspects clear, on the figure.
97499	55	0			This figure is too technical, please simplify these important messages. [Nicole Wilke, Germany]	Accepted. The figure is redesigned and its caption is rewritten to simplify technical aspects.
23433	55	1	55	1	In y-axis of Figure SPM.9 "B": "Waiting time" instead of "return period"? (or return value as used in caption). If "Waiting time" is not equal to "return value" - what is the difference? [Anna Amelia Sörensson, Argentina]	Considered. The figure is redesigned and does not contain the wording "waiting time" to simplify technical aspects.
87033	55	1	55	23	Figure SPM 9 B and D: Please consider to help the reader understand which direction and sequence to read this figure. Perhaps an example sentence could be helpful e.g. for guidance to figure B: "A 50 year event (orange) of hot day temperatures (title) will be around 25 times as frequent (left y-axis) with global warming of 4 degrees (x-axis), meaning it will happen every other year (right y-axis). Then point that sentence to the top right orange box. [Oyvind Christophersen, Norway]	Considered. The figure is redesigned and the new figure (SPM.6) does not have this issue any more.

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87035	55	1	55	23	Figure SPM 9 A and C: Please consider to help the reader understand which direction to read this figure. Perhaps an example sentence could be helpful for example for figure A: "A 50 year event of hot day temperatures (title) will in SSP5-8.4 (red dots) increase in magnitude of 0.5 to 6 degrees (y-axis) if the temperature increases by 1 to 4 degrees from one 30-year period to the next (x-axis)" 2. Then point that sentence to the red dots. Although this example sentence would make the figure easier to read, we are not sure how much information the figure actually provides to the reader. The intervals are large and the clearest message is that there is a linear relationship for all scenarios between how much hotter the hot days will be and how much the globale warming is over a 30 year period. Also, the x-axis label is currently unclear about when these 30 year periods occur. [Oyvind Christophersen, Norway]	Considered. The figure is redesigned (now SPM.6) and the caption is rewritten to improve readability.
130317	55	1			This figure, for which it is acknowledged that model output is used, has the same problem as Figure SPM.8, in that these results will not be consistent with the GSAT change shown in Figure SPM.7(a). Big problem. [Trigg Talley, United States of America]	Accepted. The revised figure (now SPM.6) uses global warming level instead of the GSAT.
29435	55	4	55	4	how is the correlation of scatter in A,C [Joachim Fallmann, Germany]	Considered. The figure is redesigned (now SPM.6) and does not contain the scatters such as those in the panels A. and C. of SPM.9.
104339	55	4	55	22	A reading aid would be welcome to enable readers to easily understand the figure SPM 9. [Philippe Tulkens, Belgium]	Considered. The figure is redesigned (now SPM.6) and the caption is rewritten to improve readability.
97501	55	5	55	5	"50-year return values": We assume these are values (magnitude), that occur once in 50 years in the reference period and are then used to calculate the return periods under different warming levels. If so, please add the notation "in the reference period". [Nicole Wilke, Germany]	Considered. The figure is redesigned to make this aspect clear.
9775	55	11	55	12	could be explained more clearly -- B and D are showing the increased frequency of hot day and heavy rainfall events compared with now (that is what is meant by the 1 st warming climate right?) and not e.g. pre-industrial. A and C also need explaining for non-specialists. Clearly very important and highly policy-relevant information. Another candidate for animated build-up? [Jonathan Lynn, Switzerland]	Considered. The figure is redesigned to make it clear that the change in the frequency is in comparison with the (fixed) return values of pre-industrial time and the change in magnitude is in comparison for the events of the same frequency across different warming levels.
82545	55	16	55	16	Should read 1850-1900 mean (not 1990). [Blair Trewin, Australia]	Accepted. This typo is fixed in the new caption.
131899	55	16	55	23	Fig SPM 9 the instruction on the key messages from the figure is nice and could maybe be placed at the top of the figure so the reader can understand the key message of the figure before ploughing through the technical details in the caption [Hans Poertner and WGII TSU, Germany]	Accepted. The newly designed figure now has the most important as the headline with larger font.
50487	55	20	55	22	Based on this final sentence: so the numbers could all change in a later draft? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	This is correct, the final figure used updated data.
50483	55	SPM9	55	SPM9	The RHS 'waiting time' axes on RH graphs: is there a reason why the 10 and 50 years line up with zero on the RH y axis? Perhaps this needs explaining in the annotation. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Considered. The figure is redesigned and new design does not contain waiting time.

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50485	55	SPM9	55	SPM9	daily heavy rainfall graphs: most models can't yet resolve convection at the global scale; does this uncertainty need to be accounted for/acknowledged in the annotation about the potential for more severe changes to future rainfall extremes? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Considered. It is true most models don't resolve convection at the global scale and modelled 1-day extreme precipitation cannot be directly compared with 1-day extreme precipitation observed at a station. But this aspect is fully accounted for in the underlying Chapter 11's assessment. The figure is also redesigned to make it more illustrative to convey the message that every increment of warming brings in additional changes in extremes. Considering all of these and the desire to make the figure less technical, the suggested acknowledgement is not added in the figure caption.
7775	55		55		Figure SPM.9: given the information provided in figure SPM.8 there seems to be the question: for which region is figure SPM.9 representative, given the regional dependence of the projected changes of extreme events? It is strictly speaking not valid for any specific region or place in the world but only for the whole world. Or in other words: a one degree change in global warming level results in quite different temperature changes in different regions. And this will result in a regional different increase in magnitude of the 50-year hot day temperature. This makes figure SPM.9 only indicative valid for a specific location; it seems therefore not very relevant for the policy level because the real world would be quite different from that abstract value reflected in figure SPM.9. If this figure is kept the limited value for a specific region should be explained. More specific analysis would be required for any specific region! [Klaus Radunsky, Austria]	Considered and we disagree with the comments. The intent for fig SPM.9 (now SPM.6) is to provide a general sense about changes in extremes that is informative even though that may not correspond to any particular location. Change in global mean temperature has been provided in a similar way for policy discussion but warming observed in global mean temperature is also not specific for any particular region. SPM does not have the space to provide real world regional values but these are provided in the underlying chapter (Chapter 11).
9577	55		55		I imagine this figure will be hard for a policy maker to interpret. Consider making it more relevant for our audience or consider dropping from the SPM. [Joelle Joelle Gergis, Australia]	Considered. Fig SPM.9 was a placeholder to showcasing the main message it would convey. This figure is not redesigned and caption is also rewritten to suit targeted audience.
26007	55		55		In figure SPM.9, please explain the meaning of "change in global warming level between different 30-year periods" [Don Alfonso Pino Maeso, Spain]	Considered. Fig SPM.9 is redesigned and its caption is also rewritten to make the figure and caption less technical. The new figure now SPM.6 does not contain wording "change in global warming level between different 30-year periods".
86515	55		56		These two figures SPM9 and SPM10 are very complex and should be in TS and not in SPM [Ala Taimar, Estonia]	Taken into account. The information from these 2 figures is now presented much more simply and we hope that the figures are more accessible.
111499	56	0	56	0	This figure is very hard to interpret. I appreciate that there's a lot of information to convey but I find this presentation difficult. Maybe a set of small "sparklines" (Edward Tufte) would work better than the pie chart elements? [James Renwick, New Zealand]	Accepted. The figure has been completely reformulated.
131901	56	0			Box SPM.3 figure 1 - this figure would be much easier on the eye if you only show slices of pie that have data - maybe the outline of outer circle could be shown but with the no data slices as transparent as [Hans Poertner and WGII TSU, Germany]	Accepted. The figure has been completely reformulated.
97503	56	0			This figure and its labels are confusing. There is too much information, are too many colours, the confidence are difficult to see, it is quite difficult to attribute a wheel to a region, the amplitude of signal unknown. Please remove or revise significantly. [Nicole Wilke, Germany]	Accepted. The figure has been completely reformulated.

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97505	56	0			Box SPM.3, Figure 1: the assignment of the circle to the region can hardly be seen. [Nicole Wilke, Germany]	Accepted. The figure has been completely reformulated.
130319	56	1	56	1	West Antarctica's pie chart is missing the signs for the direction of change. Please include. [Trigg Talley, United States of America]	Not applicable. The figure has been completely reformulated.
130321	56	1	56	1	Consider turning Box SPM.3 Figure 1 into a landscape (vs current portrait) perspective to allow for expanded resolution. In addition, the difference in the pie slice color shading from "medium" to "very high" confidence is difficult to discern on the figure. Consider, gray, brown, and black or something. [Trigg Talley, United States of America]	Not applicable. The figure has been completely reformulated.
79953	56	1	56	1	Box SPM.3, Figure 1. The intent of this figure is quite clear however the quantify of information shown makes this difficult to interpret. This loss of clarity is a pity since there is a large amount of highly useful information contained in the figure. The use of pie charts in this way requires the reader to make a substantial effort moving from legend to the chart. The use of colour to show uncertainty is lost in the colours used for the Climatic Drivers. Since the map is quite obscured suggest moving the pie charts (if retained) to a radial position around the map with lines pointing to each region. However, I would encourage consideration of a new format with a table perhaps replacing the pie charts. [Eamon Haughey, Ireland]	Accepted. The figure has been completely reformulated.
87747	56	1	56	1	Figure SPM.3: It 's very good idea to synthetise differents aspects of CID using camemberts. However, I think it's better to change the position and size of these camemberts so that the CID changes over each region will be more clearer, [Wafae BADI, Morocco]	Not applicable. The figure has been completely reformulated.
87749	56	1	56	1	Figure SPM.3: For coastal and oceanic impact driver, I think it's better to differenciate (using colors) between the 5 aspects, because when we see blue color, over SEAF e.g.it 's not clear whether this change is related to Ocean and lake acidity or coastal flood ,, [Wafae BADI, Morocco]	Accepted. The figure has been completely reformulated.
26253	56	1	56	2	It is not easy to identify to which regions the pies refer to, specially those in the Central American/ Caribbean / northern South America region. [Tania Guillén Bolaños, Germany]	Accepted. The figure has been completely reformulated.
26255	56	1	56	2	Here, similar to information in BOX SPM.3 Table 1, seems that Central America is divided into North and Southern Central America. In the Interactive Atlas there is only one CAM region, please check and if possible make consistent and in line with CH12 (WGII), where Central America is presented as an entire sub-region. [Tania Guillén Bolaños, Germany]	Not applicable. The figure has been completely reformulated.
32393	56	1	56	3	This figure is very hard to understand and to me it is rather overloaded. There are so many different colors and indicators and regions that I just get lost in it. I understand the idea of having a nice overview of the different drivers and trends, but for me this figure reaches rather the opposite and leaves me more confused. I do not have any concrete suggestions how to make it better (except maybe having fewer indicators), but I strongly suggest to think about what the readers should take from this figure and design it to fit this purpose. [Clemens Schwingshackl, Norway]	Accepted. The figure has been completely reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54751	56	1	56	3	This figure is very difficult to interpret and not suitable for an SPM. While we appreciate the attempt to synthesize regional information in some graphical way, it is nearly impossible to connect the colors in the legend to those used in, and outlining, the wedges in the figure. It is also very unclear how past changes, events, attribution results, and projections are all combined to produce a single indicator with a single confidence level. This will inevitably lead to confusion or misinterpretation. [Nancy Hamzawi, Canada]	Accepted. The figure has been completely reformulated.
131903	56	1	56	12	Figure SPM.3 Explanation needed for abbreviations used in the figure, especially in light of the fact that the symbols do not allow to see the map and allocate the changes to regions. [Hans Poertner and WGII TSU, Germany]	Not applicable. The figure has been completely reformulated.
99419	56	1	56	12	There seem to be some inconsistencies regarding the information on CID displayed in Fig. 1 of Box SPM.3 and information on D&A of extreme events in Fig. SPM.6. (e.g. regarding drought risk in CEU and NEU). Maybe Fig.1 of Box SPM.3 is also trying to convey too much information at the same time - maybe it would be better to not display attributed+observed as well as projected in the same figure? [Birgit Bednar-Friedl, Austria]	Accepted. The figure has been completely reformulated.
39545	56	1	56	12	Among the 1°C of average temperature increase since the pre-industrial period, it is seen that about 0.6°C has been achieved between 1910 and 1945 (Fig. SPM4.B) in a period when the emissions were only 11 ppm. As a result, Ring, M.J., Lindner, D., Cross, E.F., Schlesinger, M.E., 2012 (Causes of the global warming observed since the 19th century. Atmos. Clim. Sci. 2, 401–415) consider that this increase was mainly natural. This was confirmed in IPCC FAR. A part of +0.4°C since 1945 might be anthropogenic, in contradiction with the misleading approximate linearity of Fig. SPM.10 [François Gervais, France]	Rejected. Attribution of the warming increase is not correct. Fig SPM.1 does show a temporary warming between 1910 and 1945 but 1) it was followed by a temporary cooling and 2) this warming is similar in magnitude to what could be caused by natural variability only. However, since the 1950s the human influence on global surface temperature has become increasingly clear. Furthermore, the black curve in figure SPM.10 clearly shows that natural variability is overlain on top of the linear relationship between cumulative CO2 emissions and global temperature.
5755	56	1	56	12	Box SPM.3, Figure 1: Please consider using different colours for the outline of slices and the CIDs or using black lines of different style (dotted, ...). As is, it is very hard to differentiate some of the combinations and a SPM should be readable (and understandable) barrier-free. [Joachim Rock, Germany]	Not applicable. The figure has been completely reformulated.
5757	56	1	56	12	Box SPM.3, Figure 1: Please check: the pie in the lower left has no "+" or "-" signs. [Joachim Rock, Germany]	Not applicable. The figure has been completely reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
112171	56	1	56	14	This figure is a brave attempt to capture an enormous amount of detail into a single map. It seems to be based on Table 1, which is itself an even more detailed representation of expert judgement concerning regional trends. I'm afraid that the level of detail, while heroic, is also an impediment to communication of the main messages, especially in an SPM. In fact, the attempt to merge categories (e.g. six different coastal and oceanic CIDs) into single indicators, may actually undermine the clarity of messages in Table 1, which though extremely dense, does treat each CID separately. I'm not sure how to interpret trends in a combination of six very different coastal/ocean indicators. If these representations are to be useful for messaging purposes in the regions concerned, then perhaps figures like this should be reserved only for continental- and sub-continental scale representation (e.g. in the regional chapters of WG II), and then they should depict the individual CIDs, rather than some difficult to interpret composites. By definition, these are regional analyses - so why the need to present them globally? The Table does that comprehensive job - perhaps it's sufficient. [Timothy Carter, Finland]	Accepted. The figure has been completely reformulated.
38297	56	1	56	14	BOX SPM.3 Figure 1 is too complicated and uses too many abbreviations and symbols, making it difficult for readers to understand. Four types of climate impact drivers are listed in the figure, in which only "hot and cold" and "wet and dry" belong to the climatic category, while "snow and land ice" and "coastal and oceanic" can hardly be taken as climate factors. It is suggested to modify the figure for an improved readability. [Yaming LIU, China]	Accepted. The figure has been completely reformulated.
111323	56	1	56	14	Box SPM.3, Figure 1 is very difficult to read and understand. It is not clear what is for past and what is for future and for what scenario? [Volodymyr Osadchy, Ukraine]	Accepted. The figure has been completely reformulated.
130323	56	1	56	15	Figure 1 in Box SPM.3 is difficult to read and interpret. The underlying map is hard to see due to the relative size of the pie charts. Also, many of the pie charts have a lot of unused white space that do not convey information. Recommend displaying the information using smaller icons for each region that convey the same information, without white space. For example, this could be accomplished by displaying a set of colored boxes in a grid rather than using a pie chart, and only the boxes that apply to each region could be displayed, without white space. This would allow the same information to be conveyed by the figure using the same color scheme, but prevent the underlying map from being obscured by the icons. [Trigg Talley, United States of America]	Not applicable. The figure has been completely reformulated.
50489	56	1	56	15	SPM.3, Fig 1 - this is quite an overwhelming figure to take in and the detail may be easier to discern if larger. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The figure has been completely reformulated.
50491	56	1	56	15	SPM.3, Fig 1. Where a + or - is not given, it is unclear what this is indicating. Please could this category be explained in the caption. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The figure has been completely reformulated.
66503	56	1	56	15	Since all of these have at least two empty pie pieces and most have many more empty pie pieces, maybe make each pie-wedge bigger and reduce the number of them to make them more visible? [Charles Koven, United States of America]	Not applicable. The figure has been completely reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
87037	56	1	56	15	Figure 1 in Box SPM 3: It is difficult to understand what message this figure aims to convey. It is graphically overcrowded. But at the same time the information seems imprecise. It is difficult to understand which impact driver in the figure is observed and which is projected. The same colour, e.g. blue represents 5 different climate impact driver on the coast and in the ocean. Also it does not seem to be a specific pattern in where in the disc a specific colour is placed. Also no discs are filled, probably meaning that there are more "cake pieces" than necessary. Please consider to think thoroughly about the intent of the figure and what message you want to communicate. Perhaps a different type of figure with only a limited amount of information could be a way to go. [Oyvind Christophersen, Norway]	Accepted. The figure has been completely reformulated.
105613	56	1	62	2	Box SPM.3 Figure 1 hereafter referred to as 'Trivial Pursuit Figure' ;-) [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted. A dose of humour greatly appreciated.
69453	56	2	56	2	BOX SPM.3, Figure 1; Some of the regional names are hidden behind the circles. The regional names should be presented in full name in the figure caption. [Kaoru Magosaki, Japan]	Not applicable. The figure has been completely reformulated.
34569	56	2	56	3	Box SPM.3 Figure 1 looks like it was modeled after the wheels and wedges in the board game called "Trivial Pursuit." Like Figure SPM.6, this figure does not convey a clear visual message because so many indicators are packed into a very small space, only SPM.3 is even worse because one has to memorize the wedge colors before making sense of the regional wheels. [Russell Vose, United States of America]	Accepted. The figure has been completely reformulated.
50533	56	2	56	3	Box SPM.3 Figure 1 relies on a rainbow colour scheme which may not be accessible to readers with colour blindness. Please check accessibility in this regard. [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The figure has been completely reformulated.
80165	56	2	56	10	Figure: in one of the bottom pie charts there is no sign of the direction of change. 4th line: What if the observed and projected changes share different direction of change? Which one is shown? 4th line: Still misleading the usage of climatic impact drivers, simply call it climate indices maybe. 8-11th line: the confidence in the classes and the additional confidence is conflicting a bit, especially for policymakers. What does it mean high and medium confidence together? For us, the two categories are the same (confidence in the direction of change), we suggest omitting the additional confidence. [Lilian Fejes, Hungary]	Not applicable. The figure has been completely reformulated.
8223	56	4	56	4	This figure feels a bit redundant compared to figure SPM6 [Frank Dentener, Italy]	Accepted. The figure has been completely reformulated.
104341	56	4	56	4	This figure feels a bit redundant compared to figure SPM6 [Philippe Tulkens, Belgium]	Accepted. The figure has been completely reformulated.
100331	56	4	56	12	Box SPM.3 - Figure 1 is also confuse and difficult to understand. In my opinion it would be better to keep only future projections. [Claudine Dereczynski, Brazil]	Accepted. The figure has been completely reformulated.
81229	56		56		Not always easy to attribute the circle to the corresponding region in Box SPM.3, Figure 1. [Fatima Driouech, Morocco]	Accepted. The figure has been completely reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7777	56		56		Box SPM.3, Figure 1: overall, figure is ok. However, there are some comments: it is suggested to include an explanation of the abbreviations for the regions; there seem to be some changes in climate impact drivers which lack any confidence level; and there are some cases without any changes in climate impact drivers despite climate change. This needs at least some additional explanation in the caption for this figure. In addition there are also regions without indication of the name of the region. [Klaus Radunsky, Austria]	Accepted. The figure has been completely reformulated.
113003	56		56		Death by pinwheel! I'm not sure I have any concrete suggestions, but it does strike me that no single pinwheel is filled in (which makes sense), but as such this might not be the most efficient presentation of impacts. [Kim Cobb, United States of America]	Accepted. The figure has been completely reformulated.
104343	56		56		The readability of Box SPM 3 Figure 1 is very low. A gallery-view with one small figure for each of selected relevant climatic driver should be preferred. [Philippe Tulkens, Belgium]	Accepted. The figure has been completely reformulated.
26009	56		56		In Box SPM.3, figure 1, it is difficult to assign circles to regions. Also, it would be helpful to have the legend for the acronyms of regions. [Don Alfonso Pino Maeso, Spain]	Accepted. The figure has been completely reformulated.
111011	56		56		This image is too visually complex - it is very difficult to identify what regions a pie chart is related to, particularly in parts where the pies overlap. [Monica Dean, United States of America]	Accepted. The figure has been completely reformulated.
26043	56		56		BOX SPM.3, FIGURE 1. This figure is too busy with overlapping information. The synthesis effort is very worthy, but perhaps it would be better -for the sake of clarity- to split this map into two maps. One with temp/prec drivers and another one with snow and ice/coastal and oceanic drivers. [Don Alfonso Pino Maeso, Spain]	Accepted. The figure has been completely reformulated.
54749	56		56		Box SPM.3 Figure 1: While we appreciate the effort to present regional information visually, this is a very complicated graphic for inclusion in the SPM that would take a lot of time to communicate to someone. We do not support its inclusion in the SPM. This Figure, if kept, would need to explain if the bold colours represent high confidence in the direction of future changes or observed changes, expand the explanation for how to correctly interpret the coloured cell borders in terms of what kinds of lines of evidence were assessed and whether attribution studies included both assessment of regional trends and their attribution as well as location specific extreme event attribution studies. Currently, it is hard to reconcile that all coloured segments in each circle represent the # of classes for which there is high confidence in the direction of change, with the legend saying the borders for each segment differentiate between CIDs for which there may be medium confidence in results. [Nancy Hamzawi, Canada]	Accepted. The figure has been completely reformulated.
14583	56		56		Would it be prudent to mention in the caption that the size of the pie slice does not have any quantitative implication? For e.g. otherwise a reader might inadvertently assume that the size of the slice indicates the % change in the CID that it represents? [Roshanka Ranasinghe, Netherlands]	Not applicable. The figure has been completely reformulated.
132419	56				Figure Box SPM.3, Fig 1: This figure seems a bit too busy. [Sonia Seneviratne, Switzerland]	Accepted. The figure has been completely reformulated.
1911	56				I find this figure pretty confusing. Why are the colors in different positions in different circles? Which effect in a particular color applies in each location? All equally? [Alan Robock, United States of America]	Accepted. The figure has been completely reformulated.
42371	56				SPM3 figure 1. Rather complicated. A lot of information related to each symbol which makes it difficult to read. [Tina Christensen, Denmark]	Accepted. The figure has been completely reformulated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
17557	56				The concept of this figure (SPM.3, Figure 1) is good but the overlapping pie charts mean that it is very difficult to work out which region the pie charts refer to and any policymaker from some of the central/south American country, particularly, would struggle to see which pie chart was relevant to them. Where different confidence levels are adjacent to each other in a piechart, it is very hard to read. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The figure has been completely reformulated.
132009	56				Box SPM.3, Figure 1: Use of the term CID could be misleading as discussed for p. 3, lines 8 to 10: The term climate impact driver is constraining the view on climate and I am wondering whether that is useful. A holistic view of the climate system has its own value and the term climate variable would be more appropriate here. While impacts can be positive or negative, the risk concept focuses on negative consequences and has thus successfully worked with the term hazard. The benefit of using CID is thus rather limited as its use is only fully justified if impacts assessment and detection and attribution have been carried out successfully by WGII. A vague "may" does not eliminate potential misunderstanding if the term is starting to be used routinely and in passing. Suggest dropping this term as constraining its use to verified cases will be challenging. The risk concept is already starting to be confused by this. The term CID being in the WGI glossary only does indicate the need for better coordination between WGs including leadership. If maintained it needs a qualifier such as "Potential CID". [Hans Poertner and WGII TSU, Germany]	Noted. Definition of CID further refined and equivalence to hazard in the risk context clarified. The concept also allows WGI to very clearly show the many and diverse ways in which climate change is and will continue to have impacts without straying into the WGII territory of assessing these to be negative, positive or neutral.
107963	56				box spm.3 fig 1: unclear which of the depicted changes has been observed or has been attributed or is a projection. [Timothy Osborn, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The figure has been completely reformulated.
131905	57	0			Fig SPM.10 - I think this figure shown be shown or cited far earlier in the SPM. It provides basic understanding [Hans Poertner and WGII TSU, Germany]	Taken into account - Given the narrative of the SPM, the location of the figure was ultimately not changed.
97507	57	0			Very nice figure. [Nicole Wilke, Germany]	Noted
10229	57	1	57	1	Consider adding symbols for 2100. [Robert Kopp, United States of America]	Rejected - The choice was made to show the relationship for projections until 2050 because this: (1) ensures that cumulative CO2 emissions remain within the assessed domain for near-linearity available in the underlying report, (2) all scenarios continue to show increasing cumulative CO2 emissions (the domain of assessed applicability of TCRE), and (3) the importance of emissions pathways over the next 3 decades is communicated.
10231	57	1	57	1	strongly' varying levels of warming seems a bit strong of a term for the range of values shown [Robert Kopp, United States of America]	Accepted
9777	57	1	57	2	very useful development of SPM.10 vs AR5 [Jonathan Lynn, Switzerland]	Noted
37813	57	1	57	2	The scope of the scenarios is overlapped, but it is not possible to distinguish what the scope of each scenario is. Please improve it to make it easier to distinguish. [Junhee Lee, Republic of Korea]	Accepted - further improvements have been made, for example, by removing the grey cone in the background
17747	57	1	57	3	Consider renaming the y-axis according to the figure caption. [Anette Jönsson, Sweden]	Taken into account. The final SPM says 'global surface temperature'.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
130325	57	1	57	10	The text inside the figure has been cut off "for the core set of five scenarios that include" [Trigg Talley, United States of America]	Noted - and addressed
17749	57	1	57	12	It is a bit difficult to know how to interpret this figure in the context of "D.1 Limiting climate change" where it is placed. Some guidance to the figure in that context is worth to consider. [Anette Jönsson, Sweden]	Taken into account - the title of the figure intends to communicate its aim within the broader Section D of the SPM
32395	57	1	57	12	I was wondering whether it might make sense to shortly explain in the caption that the envelopes of SSP1 emissions go back at some point due to negative emissions in this SSP. [Clemens Schwingshackl, Norway]	Rejected - the figure shows projected scenario emissions until 2050 to avoid having to add this level of complexity and focus on the main message.
104345	57	1	57	12	Figure SPM.10: The description of the grey and orange lines could be clarified. Describing observed GSAT "as a function of assessed historical anthropogenic CO2 emissions" may suggests to readers that the the grey line (including its variability) is due to cumulative CO2. It could perhaps be more informative to present the orange line as "estimated human-induced warming as a function of cumulative CO2 emissions", and the grey line as an overlay representing the observed time series adjusted to the scale of cumulative emissions on the X axis. [Philippe Tulkens, Belgium]	Taken into account. Caption revised.
81879	57	1	57	12	The statement at the top of Figure SPM.10 is very powerful and easy to understand, and at first glance the figure itself conveys this message. However, on closer examination the caption, taken together with the Figure are both difficult to understand e.g. overlapping ranges and colours. [Dan Zwart, New Zealand]	Taken into account. The revised figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figures as accessible as possible. All of them now include a simple intent/statement at their top.
130329	57	1	57	14	Typically, a figure in the SPM is duplicated and explained further in the main text. This one is not. There is a comparable figure on TS-214, but there is no linkage presented between the two figures. [Trigg Talley, United States of America]	Accepted - the linkage is now explicitly included in the line of sight at the end of the caption
80171	57	1	57	14	Is there a particular reason why this figure is placed in Section D.1, limiting climate change? The figure is portraying the the global warming as a function of cumulative emission. Maybe it could be considered moving elsewhere. [Lilian Fejes, Hungary]	Noted - based on the narrative of the SPM, it was considered that the best location for this figure was section D
80173	57	1	57	14	The Figure itself and the label could be improved with the following suggestions: 1) The title above the figure is a bit exaggerating, the ever emitted part could be removed. 2) In the description and in the figure it should be GSAT, without the mean, and elsewhere 2009-2018 period is shown. 3) The 1st sentence of the description is repeated afterwards, it could be omitted, and the whole second part is basically also a repetition of what are written on the figure, so it is unnecessary in the description. 4) SSP2-4.5 lines and shading can barely be seen. Please consider using another colour. 5) We suggest using observed and modelled warming instead of assessed GSAT and without mentioning in the figure they are actually modelled outputs. 6) The observed latest decade temperature could be omitted, or simply indicating the point of now or when the scenarios start. The portrayed observational uncertainty is larger than the scenarios and previous modelled or observed data. [Lilian Fejes, Hungary]	1) Taken into account, the intent has been rephrased. 2) Not applicable. The term 'global surface temperature' is now used in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM. Changes in these quantities are assessed with high confidence to differ by at most 10% from one another, but conflicting lines of evidence lead to low confidence in the sign of any difference in long-term trend. 3) Taken into account, the caption has been revised. 4) The revised figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figure as accessible as possible. 5&6) Rejected. We think it's important to show all the historical data, as well as all the modelled data. Not doing so could be misleading.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
105639	57	1	57	14	I found Figure SPM.10 confusing. First, the line "for the core set of five scenarios that include" is compressed and difficult to read. More importantly, the abscissa and ordinate are poorly labeled. The labels on the abscissa, should include commas so lay readers will not confuse those labels with years. Overall, I found this figure challenging to understand. [Julian Levy, United States of America]	Taken into account. The figure has been revised. The annotations are no longer compressed, the x and y labels in the FGD include the units. And finally, the revised figures have been produced following a very careful co-design process involving scientists, cognitive experts and graphics designers, to make the figures as accessible as possible.
87213	57	1	57	14	Could the title of this figure ("global warming is approximately linearly proportional to the total cumulative amount of CO2 ever emitted into the atmosphere by human activities") be confusing when read against the information on tipping points in C1.4, for example? How does this figure deal with the issue of tipping points? Could this be addressed in the figure text perhaps? Is it also clear enough that both land and ocean has absorbed a lot of CO2 emissions that stems from human activities, or is this only the amount that is left in the atmosphere? Please consider ensuring that such questions are taken care of in the final version of this figure. [Oyvind Christophersen, Norway]	Taken into account - the title was kept for it to emphasize the main intended message of the visual
130327	57	1			Is this figure consistent with Figure SPM7(a)? [Trigg Talley, United States of America]	Yes
109225	57	1			SPM.10 -- is grey cone/TCRE/only CO2 necessary to show? Not sure how it is important to the overall message. Or consider showing only final range or other way that doesn't clutter/interfere with depictions of other data. Also not sure showing 2020 values is helpful, since they cannot be distinguished and will supposedly be historical by the time of distribution - without them, 2050 values could be emphasized. [Steph Courtney, United States of America]	Taken into account - the grey cone in the background was removed to improve the clarity of the figure
69455	57	2	57	2	Figure SPM.10; Assumption on projected non-CO2 emissions should be provided in the figure caption because the figure is not meaningful without the description of assumption on the non-CO2 emissions. [Kaoru Magosaki, Japan]	Accepted - The figure caption includes information on the non-CO2 emissions, noting that non-CO2 emissions evolutions are shown in Figure SPM.4
87889	57	3	57	3	Figure SMP 10: Please note that this figure gives an impression that warming is proportional to CO2 emissions and independent of the non-CO2 forcing (since the effective TCRE curves for different SSP scenarios are nearly co-linear). However, non-CO2 forcing is one of the largest uncertainties in the remaining carbon budgets for 1.5C, if a larger set of more plausible scenarios is considered. Since Chapter 5 outlines a new methodology that uses only CO2-induced warming (TCRE), and assesses contributions from non-CO2 forcing separately, this figure and its caption should clearly state the caveat that remaining carbon budgets should not be directly read off the effective TCRE curve. In its current form, this figure may lead to confusion and misinterpretation of the remaining carbon budget. [Katarzyna Tokarska, Switzerland]	Taken into account - Figure SPM.10 illustrates the overall insight that global warming is nearly linearly proportional to cumulative emissions of CO2. The influence of non-CO2 assumptions on carbon budgets is highlighted in Table SPM.2
50493	57	7	57	8	The grey cone shows the relationship informed by the assessed likely TCRE range - is this TCRE if ONLY CO2 is emitted, as described on the figure itself? Please make clear here what the assumptions are re other warming species. i.e are they excluded completely or assumed to be constant? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - to make the figure easier to understand, the grey cone was removed

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3585	57		57		Figure SPM 10. It would be better to draw vertical lines, same way as SR1.5 Figure 2.3, at 2020 cumulative emissions (circle mark) and 5 cross marks of 2050 emissions and add cumulative emissions figures on the x axis. In addition, please draw horizontal lines at temperature increase for 1.5 and 2 °C. [Mitsutsune Yamaguchi, Japan]	Rejected - This visualisation intends to illustrate the general near-linear relationship between cumulative CO2 emissions and global warming. It is not intended to be used to read off carbon budgets. Table SPM.2 provides that information.
112929	57		57		It strikes that that this figure will be widely reproduced and in doing so, it will need to be stripped down to its essentials. Therefore, I would think about constructing any annotations (arrows and text boxes) so that they can easily be removed. The key figure from 1.5 was pretty difficult to teach with, for example, bc it was hard to strip down and clean up. I hope that we design figures in the SPM with that express goal in mind. [Kim Cobb, United States of America]	Taken into account - the figures have been designed with their re-use in mind
7779	57		57		FIGURE SPM.10: The figure is useful and welcome. However, there are some issues, mainly with the figure caption but also the description of parameters inside the figure. One issue relates to the qualifier "assessed" - it is used in the context of e.g. global annual mean surface air temperature, human-induced warming, global warming, historical anthropogenic CO2 emissions. And then there is the qualifier "modelled" (modelled 90% uncertainty range). It might be clearer to delete the qualifier "assessed" because all information included in the Assessment reports are expected to have been assessed by the authors! However, it would be helpful to clarify which data have been based on observations, on projections or models. [Klaus Radunsky, Austria]	Taken into account - The caption was edited for clarity and accuracy, but technical details were not repeated in the SPM, as they are better positioned in the TS and underlying chapters.
7781	57		57		FIGURE SPM.10: It would also be helpful to limit the terms used, e.g. when it comes to global warming. E.g. Global mean surface air temperature increase versus annual mean GSAT increase: The reader who is not an expert would automatically think that different wording describes different issues - it is very important to strictly limit the use of terms to those that have been identified in the glossary. And once a term has been defined in the glossary it should be used throughout the assessment report in only one wording! Otherwise this would trigger confusion and misunderstandings. [Klaus Radunsky, Austria]	Taken into account - The caption was edited for clarity and accuracy, but technical details were not repeated in the SPM, as they are better positioned in the TS and underlying chapters.
7783	57		57		FIGURE SPM.10: Description of the figure: The qualifier "illustrative" is used in the context of uncertainty. What is the meaning? In the glossary "illustrative" is only used in the context of marker SSP scenarios. It is suggested to delete illustrative in other context. The alternative would be to include the term "illustrative uncertainty" in the glossary - provided it is used in the scientific literature in that context. [Klaus Radunsky, Austria]	Taken into account - The caption was edited for clarity and accuracy, but technical details were not repeated in the SPM, as they are better positioned in the TS and underlying chapters.
7785	57		57		FIGURE SPM.10: It is unclear why for some terms the full wording is used (e.g. Global mean surface air temperature) whereas for others (TCRE) only the abbreviation is used; I expect that only very few readers would know that this abbreviations stands for "transient climate response to cumulative emissions". It is strongly recommended to use the same approach throughout the assessment report. Otherwise it would again be confusing and could trigger misinterpretations. [Klaus Radunsky, Austria]	Taken into account - TCRE is defined earlier in the SPM.
7787	57		57		Figure SPM.10: The text "Assessed human-induced warming and likely range between 1850-1900 and 2010-2019" is unclear. The following wording is suggested: "Likely range for the human-induced global warming between 1850-1900 and 2010-2019". [Klaus Radunsky, Austria]	Taken into account - The caption was edited for clarity and accuracy, but technical details were not repeated in the SPM, as they are better positioned in the TS and underlying chapters.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7789	57		57		Figure SPM.10: The text "Human-induced warming with illustrative uncertainty range" is unclear. The following wording is suggested: "Human-induced global warming relative to 1850-1900 with indicative uncertainty range". [Klaus Radunsky, Austria]	Taken into account - The caption was edited for clarity and accuracy, but technical details were not repeated in the SPM, as they are better positioned in the TS and underlying chapters.
7791	57		57		Figure SPM-10: The figure shows no further global warming for SSP1-1.9, SSP1-2.6 and SSP2-4.5 but only for SSP3-7.0 and SSP5-8.5. It is suggested to include some explanatory text in the figure caption - conveying the message that for the SSP1 and SSP2 scenarios temperature stabilization has to be expected during the 21st century in the indicated range whereas for SSP3 and SSP5 scenarios further global warming beyond the 21st century will happen. [Klaus Radunsky, Austria]	Taken into account - the figure callouts indicate that the scenarios are shown until 2050. The message of temperature stabilisation is already captured in other SPM figures, and SPM.8 in particular.
104347	57		57		Figure SPM.10 is very useful. Please investigate different colour schemes for the SSPs. The X/O formulation and labelling is very useful for distinguishing between the scenarios in 2020 & 20102:125150. However, it is difficult to follow these scenarios beyond 2050 as the colours merge together. Perhaps a symbol could be added also for the 2100 values. Another possibility could be to use zoom panels to better describe the situation for each scenario. [Philippe Tulkens, Belgium]	Taken into account - for consistency across all SPM figures and other parts of the WG1 report, SSPs are shown in the same colour scheme throughout.
116139	57		57		Figure SPM10 could be part of a broader visual representation including a schematic explanation for elements considered for the calculation of remaining carbon budgets, and with the corresponding table. [Valerie Masson-Delmotte, France]	Rejected - this would typically be something to be included in the TS, rather than the SPM.
108217	57		57		SPM.10 There are some presentation issues with the text in the image (assessed likely range...etc. is cut off). This would be an excellent candidate for presentation in an interactive way, where users can select an element, and it would be highlighted in the graph to be more clearly discernible for the rest of the data. [Anton Holland, Canada]	Noted - and addressed
54753	57		57		Figure SPM.10: Important to provide this updated version of the cumulative emissions vs global temperature change graph from the AR5. We just have one comment. While the grey wiggly line seems to show observed changes in global mean temperature including the ups and downs reflecting natural climate variability, the label for this curve says it shows "assessed global mean temperature change due to historical CO2 emissions". Would not the global temperature change due to historical CO2 emissions be a straight line? Something is unclear here. [Nancy Hamzawi, Canada]	Accepted - the historical temperature is noisy due to internal variability, while the anthropogenic component is plotted in a much more smooth line in the back.
54755	57		57		In addition to the symbols for the five scenarios in 2020 (circles) and 2050 (crosses), it would be helpful to add a new set of symbols for year 2100. [Nancy Hamzawi, Canada]	Rejected - The choice was made to show the relationship for projections until 2050 because this: (1) ensures that cumulative CO2 emissions remain within the assessed domain for near-linearity available in the underlying report, (2) all scenarios continue to show increasing cumulative CO2 emissions (the domain of assessed applicability of TCRE), and (3) the importance of emissions pathways over the next 3 decades is communicated.
80475	57				fig SPM.10: What is the key message of the figure ? It seems that the 1.5 degree limit is passed in all SSP scenarios by 2050. [Leo Meyer, Netherlands]	The key message is stated in the title of the figure
17559	57				While the figure illustrates the title perfectly, the detail is extremely difficult to understand. [Susan Escott, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The figure has been revised, together with communications specialist, to improve accessibility

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111013	57				While the figure illustrates the title perfectly, the detail is extremely difficult to understand. The gradient colors are also not likely to be accessible to colorblind users. [Monica Dean, United States of America]	Taken into account - Each feature in the figure is accompanied by an explicit label
84095	191	1	57	1	Text inside the plot (top right) is hard to read [Marco Tulio Cabral, Brazil]	Noted - and addressed
84097	191	1	57	1	Suggestion - write the label of the y axis close to the axis in vertical alignment [Marco Tulio Cabral, Brazil]	Noted - the figure was further improved for readability
84093	191	2	48	2	The measurement unit of temperature appears twice in the label of y axis of Plot B, [Marco Tulio Cabral, Brazil]	Taken into account. Figure was completely revised.
84101	191	23	5	24	... Human activity has increased its impacts on the climate system since the mid-20th century. In several parts of this document , in particular chap 3, it is mentioned observations of human activity and its impact on the climate system since earlier times. The activities that are driving the current climate change have not started in the XXth century, but increased their rate at this point in time. [Marco Tulio Cabral, Brazil]	Taken into account. Mid-20th century no longer mentioned in headline statement HS1
84099	191	31	4	32	the session 1.3.3 also mentions the importance of extraction and combustion of fossil fuels, landfills, as human related drivers. They should also be mentioned here. [Marco Tulio Cabral, Brazil]	Not applicable. bullet point removed from revised SPM, to shorten the SPM and focus on what matters most to policy-makers.
78965	20	15	22	24	In this box SPM2, and especially in Box SPM2 table 1, it is particularly important to increase the comparability with AR5 and SR15. We would like to see the GMT increase expressed in a way that is comparable to AR5. We understand that the reference time period changes with every IPCC AR cycle, but that makes it even important to define a common reference and explain the results with that reference, explaining what comes from the change in model behavior, the changes in forcing, or the change in scenarios, and excluding any artifact such as reference time period or changes in definition of average temperature. Please consider providing the average global warming above pre-industrial for both for CMIP5 scenarios as well as CMIP6 scenarios with the same definition of mean temperature. [Martine Vanderstraeten, Belgium]	Taken into account. Some connection to AR5 is now made, but it would be confusing to the readers to present two parallel assessments.
50495	Box SPM3 Fig				The coloured borders denoting the strength of evidence coming from multiple sources are quite hard to see and differentiate. Why not use hatching and stippling instead? [Jolene Cook, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. The box has been removed.
44685		4	3	4	The SPM also uses GMST and it is not readily obvious why sometimes the one and why sometimes the other. The reason for should be made clear. Preferably, usage of only one would add lucidity. The same applies to the use of two reference periods (footnote?). [Markku Rummukainen , Sweden]	Taken into account. Following the SOD review, changes in GSAT and GMST were re-assessed and are found to differ by at most 10% from one another (high confidence), but conflicting lines of evidence lead to low confidence in the sign (direction) of any difference in long-term trend. {Cross-Section Box TS.1} As a result, GSAT is no longer the principal metric of the report but, instead, the term 'global surface temperature' is now used interchangeably, in reference to both global mean surface temperature and global surface air temperature throughout the revised SPM.

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19379			19	22	The future scenarios need to be presented in a way that does not require reading of the relevant chapter first. As it is, they are presented in the SPM with no explanation of what they are or why there have been multiple versions of these since AR5. They are variously and imprecisely called emissions scenarios, radiative forcing scenarios, climate policies, and, worst of all, climate mitigation scenarios (does climate ever need mitigation?). The numbering scheme is indecipherable without lots more background. [Steve Colman, United States of America]	Taken into account. The 5 core SSPs are now introduced in Box1 of the SPM. A Glossary entry into the concept of SSPs is also present. Scenarios are now more clearly referenced in the new version of the SPM.
111109					Table SPM.1. I liked that the extremes tables connected past and future to see where observations supported future changes. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted but the table has been removed in the revised version.
81927					It would be useful to have a section up front that identifies the most important changes between AR5 and AR6, rather than having comparisons scattered throughout the SPM. [Dan Zwartz, New Zealand]	Noted. We have significantly reduced the length of the SPM and do not have enough space to cover that in a short SPM. The improvements since the previous reports are however highlighted in the revised TS. Novel aspects of science in the AR6 are indicated in the SPM, for example in HS A3.
81933					Please ensure the language used throughout the SPM is not colloquial or subjective, for example the authors could consider using more precise language for A1 “several centuries”, “now an established fact”, “have increased knowledge”. [Dan Zwartz, New Zealand]	Taken into account. Language of the SPM significantly revised.
29205					The definition and the meaning of the term "projection" in the context of IPCC should be given with reference to the term "prediction" for the self-containment of SPM. [Hiroshi Kanzawa, Japan]	Rejected. "prediction" does not appear in the revised SPM and both terms appear in the glossary.
130331					[ENSEMBLES] The SPM needs a simple explanation of the socio-economic assumptions in SSPs 1-5. Policymakers will want to know and need to be able to explain the difference in SSPs. [Trigg Talley, United States of America]	Rejected. It is not possible for us to include a complete description of the SSPs in the SPM, due to space constraints and because it is not within the mandate of WGI to cover the development and socio-economic assumptions behind the SSPs, which is within the mandate of WGIII. Note however that more information about the SSP is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4, which are all provided as lines of sight in box SPM.1.
130333					[ACCESSIBILITY] Overall, the summary is very dry and not written for a general policymaking audience. May of the terms don't seem to be defined (e.g., TCRE and ECS on page 24). The summary would benefit from having some examples to conceptualize the major findings for a non-science policymaker. [Trigg Talley, United States of America]	Taken into account. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make the document more accessible to a general policymaking audience.
130335					[PROGRESS] When discussing changes between AR5 and AR6, there seems to be little mention of land surface and BGC and changes between CMIP5 and CMIP6, and how that data is used in ongoing Working Group contributions to the AR6. [Trigg Talley, United States of America]	Noted. Please refer to Chapter 5 for this topic.
130337					[ACCESSIBILITY] The SPM should be shortened. Summaries of the different chapter sections should be tightened and trends in the data should be stated instead of giving specific data values. Currently some summaries are too technical. [Trigg Talley, United States of America]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible.

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130339					[ACCESSIBILITY] The Summary for Policymakers is far too long and too detailed. Recommend shortening these summary sections to give the main take away points and a short sentence referencing the data that help to come to this conclusion/interpretation. Otherwise policymakers might not take the time to read this section fully or even be able to interpret it. Also, might be worthwhile to reference the Atlas over the technical chapters for policymakers since the Atlas appears to be more digestible. [Trigg Talley, United States of America]	Accepted. We significantly reduced the length of the revised version of the SPM.
130341					[ACCESSIBILITY] The density of information is very high and only the most committed and diligent reader will be able to read and assimilate the 57 pages. Suggest a "summary" of the summary. [Trigg Talley, United States of America]	Taken into account. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible, to make the document more accessible to a general policymaking audience.
130343					[PROGRESS] The beginning of the SPM should emphasize what is new in this report: What is different from or added value from previous WGI reports or the Special Reports from earlier in the AR6 cycle. Key to this would be emphasizing the explosion of regional climate information since AR5 and how much more of the WGI report is now dedicated to regional information than in any previous report. [Trigg Talley, United States of America]	Taken into account. Updates in AR5 can be found throughout the SPM. Please refer to The first section of the Technical Summary for more detailed information on updates since the Special Reports and AR5.
130345					The Summary for Policymakers is a critically important part of this report, and must clearly communicate both the gravity and dimensions of the climate crisis (Sections A, B, C) and the most promising strategies and tactics for mitigation and adaptation (Section D). The current SPM clearly outlines the increased level of confidence that human activity is driving climate shifts based on additional research since AR5, the regional specificity of certain climate impacts, and the state of research underpinning alternative mitigation strategies. Yet, the SPM could communicate more effectively to policymakers the gravity of the crisis humanity faces, and what can and must be done to avert catastrophe. [Trigg Talley, United States of America]	Rejected. The mandate of the IPCC WGI is to assess the available literature on the physical climate characteristics of climate change. WGII and WGIII have the mandate to assess impacts on humans and ecosystems and how to mitigation climate change.
81213					Some subsections (i.e A.2.5, A.2.6) should be rephrased to avoid misunderstanding about confidence in future projections and the current knowledge about the future changes [Fatima Driouech, Morocco]	Taken into account. Section A has been removed, with the main findings incorporated in the new section 'current state of the climate'. As a result, we now believe that the new structure : -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change now prevents the potential misunderstanding pointed out in the comment.
12095					It would have been nice to have a plot of all 3 major GHGs explicitly. Now Only SPM Fig. 1 shows CO2 in a simple way! [Prabir Patra, Japan]	Taken into account. Figure SPM.4 now shows emissions of CH4 and N2O.
69963					I think SPM is too long. It should be shorter (to around 30 pages). Although overall descriptions in the SPM are very worthy and informative, some contents of section A are especially seemd to give similar and repatitive information with section B and/or C. In order to reduce total pages of SPM, I would like to suggest that simple sentences should be phrased with focusing to new findings since AR5. [Young-Hwa BYUN, Republic of Korea]	Accepted. We significantly reduced the length of the revised version of the SPM.
116055					Including authors from WGII is possible. [Valerie Masson-Delmotte, France]	Noted.

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116061					Changes in the biosphere are not mentioned in part A of the SPM. As part of the context of the emergence of human induced trends, references to pressure on land and ecosystems (as done in SRCCL) could be relevant to place this report in a broader context (nuances to human-induced changes from effects on the global climate system and from local pressures). There are related statements in multiple chapters (including linked to causes for greening trends, effect of urbanisation etc) and this could also be highlighted in part A. [Valerie Masson-Delmotte, France]	Taken into account. Biosphere is now covered in HS1.8.
116063					It is hard to understand in the SPM what aspects confirm, strengthen findings from AR5 and SR15, SROCC and SRCCL; where the AR6 WGI assessment revises earlier findings substantially; and what is novel (not previously assessed). I suggest considering pictograms (as done in the SROCC SPM to relate statements to chapters) but here to highlight these changes from earlier assessments. For this purpose, there could be an appendix table comparing key findings x SPM of these reports to support the development of the pictograms. [Valerie Masson-Delmotte, France]	Taken into account. This is covered in the TS where a subsection is dedicated to improvements/new findings compared to previous reports.
78953					For comparability for example with AR5 and SR1,5°C, and to avoid confusing policymakers, there is a need for coherence of this report with the previous reports. If not a change of approach or methodology needs to be explained, for example why this latest methodology or approach is better than the one previously used. [Martine Vanderstraeten, Belgium]	Taken into account. Greater efforts have been made to be consistent with previous IPCC Reports and any differences in methodologies have been explained for traceability. The Technical Summary introduction section also covers key updates since the Special Reports. This could not be included in the SPM due to space limitations.
77677					The preambles are a good way to introduce each of the four SPM sections. The technical summary has a table of contents, not this SPM. I suppose this SPM will be a section within the synthesis report for AR6, as for AR5. [Emer Griffin, Ireland]	Noted. The revised SPM does include a table of content.
77681					Box SPM.2, Table 3 : perhaps 2 subheadings below each other (relative to 2015 above 2030, 2050...). Table on two pages. [Emer Griffin, Ireland]	Not applicable. Table removed.
81267					Figure 1 in Box SPM.3 is very important but will not be easy to read/understand by many people [Fatima Driouech, Morocco]	Accepted. The figure has been completely reformulated.
116089					There is a need to check how the following aspects are addressed throughout the SPM : ozone; monsoon; clouds to make sure that recent knowledge on these aspects is correctly features in the SPM. [Valerie Masson-Delmotte, France]	Accepted. Checked.
108165					This section of the document is the Summary for Policy Makers. Yet all of the content in this entire part of the report is written in a style that is aimed at scientists and technical experts. A much more plain language approach is needed if this is going to be a useful tool for policy and decision makers, who, by and large, are not scientists and technical experts. This is an extremely difficult text for them to navigate and consume, and therefore their interpretations of what's contained in this document will be prone to error. The readers of this document are not trained as scientists to deal with the technical nature and density of the text as written. [Anton Holland, Canada]	Accepted. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
112517					Is there a glossary provided to readers who only read the Summary for Policy Makers? (I know there is a glossary for the overall report.) At present there is a box glossary, but there does not seem to be an overall glossary for the SPM. Providing a glossary for the SPM, or reference to the larger Report Glossary might be useful. [David Tindall, Canada]	Noted. A glossary is available for the entire report

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42375					Figures are generally very good. High res images (and datasets) should be made available, when report is released. [Tina Christensen, Denmark]	Noted with thanks.
108167					Expressing the same concepts in plain language can be done without losing the technical integrity of the text if done by a skilled practitioner. The gravity of the situation the world is currently facing with respect to climate change and its impacts demands that we invest time and resources on making this summary for policy makers a truly useful tool for them. They will need these concepts explained in much clearer terms if they are going to use this information in their own efforts to guide government representatives and members of the public towards appropriate action on climate change. [Anton Holland, Canada]	Taken into account. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
44679					To the extent possible, please provide information for the whole projection range and not only for single or subsets of emission scenarios. In some case, some generalised expression might be useful, e.g. "... for all projections..." or "...all projections with magnitude depending on scenario...", as appropriate. [Markku Rummukainen, Sweden]	Taken into account. We are trying to strike a balance between comprehensiveness and readability.
112519					What does human influence mean? Perhaps this seems obvious, and I believe I know what it means, but it does not seem to be defined in the SPM. It might be useful to clarify, and give some examples. [David Tindall, Canada]	Accepted. Human influence is now defined in footnote 4 in the introduction.
107657					P. 37: Box SPM.3, Figure 1: the Mediterranean includes also Northern Africa and parts of Asia. Please correct by "southern Europe" [Omar Chafki, Morocco]	Noted. The name used is the official AR6 WGI reference region name. It is also used for relevant parts of North Africa and this is made clear in the text where it is also included in the Africa synthesis of results.
42377					Language is very technical and uses an abundance of technical abbreviation, which are not necessarily known to the lay reader. One can not expect the audience to be familiar with IPCC lingo and reference to for instance CMIP runs. Consider if plainer language could be used/ and/or include a list of abbreviations and plain language explanations. [Tina Christensen, Denmark]	Taken into account. The revised SPM is less technical, it uses much more plain language and avoids acronyms as much as possible. It has been revised in collaboration with communication experts.
108169					For example, the explanation of confidence and calibrated language is crammed into a footnote. This should be brought out into the main body of the report, expressed in clear language, and formatted so that it is much more visibly consumable by the reader. [Anton Holland, Canada]	Rejected. The IPCC calibrated language has been used for a very long time in summaries for policy makers. Including a footnote on the uncertainty language is in line with past practice (see for instance the SPMs of the last 3 special reports SR1.5, SROCC and SRCCL).
112521					This reviewer is a social scientist. It is my informed opinion that from a social science perspective D.5.4. is correct. I would just like to highlight the importance of this claim. For many audiences, providing more comprehensive and accurate scientific information will make little difference to their decision making and actions. Other types of communications strategies need to be undertaken. And as D.5.4 makes clear, there is no single audience. Different communication strategies need to be developed for different audiences. [David Tindall, Canada]	Noted
42379					The report is too long and needs shortening. [Tina Christensen, Denmark]	Accepted. We significantly reduced the length of the revised version of the SPM.

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108171					Overall, there should be a much higher use of visualization techniques to present complex information more clearly. [Anton Holland, Canada]	Taken into account. We significantly reduced the length of the revised version of the SPM and tried to simplify the language wherever possible. Additionally, the figures have been completely redesigned in a co-design process involving scientists, communication experts and graphics designers. We now believe that the revised document is much more accessible to a wide audience.
112523					I did not detect any obvious errors in this draft. Overall, the SPM seems very thorough, and clearly written. Though, in its present form, only highly motivated readers are likely to read it in detail due to its style, structure, and length. Perhaps this is to be expected at this stage? Though, allowing the figures to take centre place in the final document will mitigate these issues somewhat. (As opposed to their be listed at the end of the document.) [David Tindall, Canada]	Noted. The revised SPM is simpler and shorter so, hopefully, more accessible.
131981					As is typical for SPMs in statu nascendi some bullets could have, but are lacking key quantitative detail which would make findings much more illustrative. [Hans Poertner and WGII TSU, Germany]	Taken into account. Quantities have been added wherever possible.
116111					Could tables combining what is observed now (1°C of global warming), attributed, and what is projected for 1.5°C, 2 or 3°C of warming (including a more explicit treatment of emergence) be included in the SPM for trends and extremes? [Valerie Masson-Delmotte, France]	Rejected. To shorten the SPM we had to reduce the number of tables and we now only include 2 tables, which are not on extremes.
87443					The SPM reads generally very well. I did come out of it a little unsure of two matters. First, the importance of, and current understanding of, the global carbon budget was not really clear. Second, the relationship between aerosols (and their various sources), ozone, and temperature rise was quite difficult to follow. [Stephen Humphreys, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The revised SPM is simpler and shorter so, hopefully, more accessible.
116117					The choice of scenarios displayed in panels and tables needs to be discussed and explained. [Valerie Masson-Delmotte, France]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. However, we refrain from providing more detailed discussions and explanations of the SSP scenarios (choices) in the SPM given the limited space and the focus on the physical climate outcome from scenario-based climate projections. Detailed information on the set of illustrative scenarios considered is provided in section TS1.3.1, Section 1.6.1 and Cross-chapter Box 1.4.

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116119					The choice of scenarios displayed in panels and tables needs to be discussed and explained. For instance, for aspects considered here (eg CID trends), how much do results projected until 2050 depend (or not) on the scenario, and what differences are expected from low to high emission scenarios (eg between 1.5 and 2°C of warming basd on Box SPM2). [Valerie Masson-Delmotte, France]	Taken into account. The set of illustrative scenarios consistently used across the WGI report and also in the SPM is now briefly explained in the new Box SPM.1, introducing the climate models and scenarios. The assessed climate projection results are now largely covered in Section B "our possible climate futures. The results tables have been removed from new Box SPM.1. Results for CIDs based on climate model projections using those scenarios are discussed in the revised Section C "Climate Information for Risk Assessment 1 and Regional Adaptation", e.g. new HS.11, also in terms of warming levels such as 1.5 or 2°C.
9625					I applaude the change from GMST to GSAT. It makes a lot more sense to me. I am happy with the 1850-1900 reference period although it is not clear how it relates to the Paris Agreement. I also like the fact that future temperature changes are also expressed relative to the 1850-1900 and not just relative to the present-day (as was the case in AR5). This is more in line with the Paris Agreement. This said, I find it a bit confusing to have multiple periods for the present-day: 1995-2014, 2010-2019 and even 1981-2018 in Fig SPM5. The SPM would be more self-consistent if only one present-day period were to be used. [Olivier Boucher, France]	Noted with thanks. The reference periods of the revised SPM have been harmonised, using 1850-1900 wherever possible.
116133					While the storyline approach is mentioned, it is not used, could there be examples of storylines in a box in the SPM? [Valerie Masson-Delmotte, France]	Not applicable. Storyline is no longer mentioned in the revised SPM.
116141					The treatment of non linearity, irreversibility, abrupt change is limited currently in the SPM (what is new compared to AR5- SROCC) (related storylines?) [Valerie Masson-Delmotte, France]	Taken into account: Storylines have been removed and more reference to the risk framing and other novel AR6 aspects have been added.
9647					General comments: I find this SPM to be in very good shape for a FOD. I felt, but I may be wrong, that there isn't much that is different from AR5. Differences to AR5 should be better emphasized. Is there a novel element that could be better put forward? I feel that the warming projections are too conservative and will comment more specifically on this. [Olivier Boucher, France]	Taken into account. We have tried to better highlight the progress since AR5 (e.g. see HS4.4)
19377					The perspective that paleo data provide for current climate change is severely under-represented in the SPM. Chapter 2 and the Technical Summary are much better in this regard, and that representation should be included in the SPM. [Steve Colman, United States of America]	Taken into account. The new HS2 relies on paleo information to put recent into a (pre)historical context.
116145					The SPM appears somehow disconnected between the framing (part A) and the presentation of results. Could examples of constructing a regional climate message be also included (as done in WGII for case studies)? This could also build on snapshots from the atlas. [Valerie Masson-Delmotte, France]	Taken into account. The revised SPM has a completely new structure where the logical flow has been improved. The new sections are: -The Current State of the Climate - Our Possible Climate Futures - Climate Information for Risk Assessment and Regional Adaptation - Limiting Climate Change
132019					Figure SPM3: the right hand panel is not traceable in the TS - it seems that TS13 has different values (see obs.). Also what does the blue bar represent? It is not reproduced in the TS figure. [TSU WGI, France]	Taken into account. Figure is clarified

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132023					Figure SPM4: the regions will have to be updated to match Box TS.5 Figure 2 [TSU WGI, France]	Taken into account. Regions consistent with other figures and TS.
132029					Box SPM.3, Figure 1: this figure is hard to understand due to the amount of information layers provided (CIDs+ broader group, type of sign of change, confidence, geographical info) and the type of visualisation that was chosen to represent them [TSU WGI, France]	Accepted. The figure has been completely reformulated.
132031					Figure SPM.6: some events mentioned in the HS are not present in the figure (i.e. wild fires in the mediterranean region, marine heatwave). [TSU WGI, France]	Not applicable. Figure significantly revised (now fig SPM.3) and the visual approach is completely different as only 3 variables are now shown.
116161					The word "cloud" is mentioned only 4 times in the SPM, does it correctly capture knowledge progress? [Valerie Masson-Delmotte, France]	Noted. It is now only mentioned once. However, covered more fully in the TS
77281					be useful to have a conclusion on deoxygenation for consistency through to the SPM as there deoxygenation is mentioned in the SPM [Emer Griffin, Ireland]	Accepted. Deoxygenation addressed in HS1.6
111085					A very good first draft, engaging, different in interesting aspects from before. [Gabriele Hegerl, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.
77561					For the Summary, terms such as "Equilibrium Climate Sensitivity" and "Transient Climate Response" might need to be clarified/simplified and their usefulness made clear. [Emer Griffin, Ireland]	Taken into account. The revised version is much less technical than before (e.g. Transient climate response is no longer mentioned).