SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
15423	1	0	0	0		This chapter contains main text, 4 Cross-Chapter Boxes (24 pages), 3 FAQs and an appendix. It exceeds the page limit, even when discounting the boxes and FAQs. [EUCE, Belgium]	Taken into account: The main text was 16% over-length. Revisions of the FDG will work to reduce length.
18125	1	0	0	0	0	The second draft of the SROCC report's chapter 1 reflects the outline agreed upon by the IPCC during the scoping meeting; all topics/bullet points are covered in the Chapter albeit in a slightly modified order. However, the proposed Chapter length of 15 pages is grossly exceeded (73 pages with current layout). During our group review, we found that the authors could strengthen the message that changes in ocean and cryosphere matter to everyone on Earth, not only people living along the coasts or at high latitudes. The profound dynamic and thermodynamic coupling between the atmosphere and the ocean could also be made clearer. The case studies in Cross-Chapter Box 2 (p. 28-32) should be introduced better and their selection motivation explained as they now seem to be rather random examples. Regarding to the figures, most of the group were not satisfied with their quality. Many of them contain too much text and/or detail, preventing non-scientists from fully understanding the message those figures aim to convey (e.g., Fig. 1.2 with a lot of text, Fig. FAQ 1.2 with unreadable text, yet very little information; more details included in our reviews). Some clarification of the terms included in figures of the report are needed (e.g., Box 1 Fig. 1, there may be something missing as the right portion of the figure seems to be incomplete?). We also think it would be good to have a short paragraph on icebergs and calving events here. This is mainly because of recent attention of calving of Larsen C ice shelf and resulting significant mass loss from polar regions. The quality of the writing of this chapter is acceptable, yet it could be more homogeneous to make it more understandable (e.g., the part on resilience on p. 15 -16 is rather generic and broad, appearing like an opinion, rather than facts). The group also suggested that the summary can be improved as it seems a bit choppy at the moment. Some of the chosen literature may be hard to access for non-expert readers, better alternatives have been suggested in our detailed review comments. Lastly, we all agree that although not everything we reviewed has been within our expertise, yet we found it useful to have non-experts reviewing this piece. It has been easy and straightforward to read in general. [APECS Group Review, Germany]	Taken into account: The approved length refers to IPCC formatted pages not the number of unformated pages in the review document. The SOD of the main chapter text was 2-pages (16%) over length, and revisions will work to reduce this. A lot of text has been removed from fig. 2.
23897	1	0	0	0	0	As the treatment of the contents in Chapter 6 (Extremes, Abrupt Changes and Managing Risks) seems to need further clarification, perhaps it might be helpful if Chapter 1 could include the explanation of the importance of the contents in Chapter 6 in relationship to Chapters 2 to 5. In addition, the importance of such relationship will need to be reflected in the Executive Summary. [Government of Japan, Japan]	Accepted: additional cross referencing to chapter 6 has been added in the chapter (e.g. section 1.4)
190	1	0	0	0	0	Detection and attribution at loca/regional scale levels needs more emphasis [Mustafa babiker, Saudi Arabia]	Rejected: This is a good point but we don't have space in chapter one to expand on these details. Fundamentally the detection and attribution technique is the same for global scales as for local/regional scales.

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5225	1	0	0	0	0	I suggest that joint with the analysis of climate change effects over the population in oceans and cryosphere, analyze too the vulnerabilities, hazards, and risks over the biodiversity because they are intrinsically vinculated. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Noted: Chapter 1 does not assess, but we do introduce the concepts used in the rest of the report, including those mentioned by the reviewer
5235	1	0	0	0	0	Would be mentioned the Figure reference where was extracted or it is an authors construction. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Rejected: It isn't clear which figure is being refered to, but all figures are original.
10481	1	0	0	0	0	The overall structure of Chapter 1 is excellent, especially the integration across physical and social science. I especially like Cross-Chapter Box 1, Figure 3 on sustainable development pathways, and cross-chapter box 3 on "Indigenous Knowledge and Local Knowledge". [James Renwick, New Zealand]	Accepted: Thank you.
12053	1	0	0	0	0	1. The boxes in this chapter (or in the present report) are too long, which significantly compromises the integrity and readability of the present report. So it is suggested to shorten the boxes and delete the list of citations therein. 2. The core concepts like "cryosphere" and "Coast" in this chapter should be described in terms of specific meaning and scope in the present report and be included in the glossary. [Government of China, China]	Accepted: The length of the boxes in the FGD are consistent with IPCC guidelines. References for the CCBs have been incorporated in the main chapter 1 reference list in the final formatted version of the report. Key terms for cryosphere and ocean have been added to the glossary.
15221	1	0	0	0	0	We appreciate the concept of loss & damage being introduced in Cross-Chapter Box 1. However, the links to specific chapter assessments relevant for this topic should be strengthened. In the context of loss & damage, adaptation limits play a crucial role. Please make sure to establish this link more clearly here. The SR1.5 box on Loss and Damage could provide useful guidance. Furthermore, it does not appear that this concept is then streamlined to other chapters. [Government of Gambia, Gambia]	Taken into account: Loss and Damage was treated extensively in the Special Report on 1.5 °C. Given the short time elapsed between the SROCC and SR1.5 report release, the treatment of loss and damage in the SROCC has been limited to Chapter 1, including CCB1 on risk, briefly in Chapters 2, 5, and 6, and CCB 9. The academic literature further connecting the dots on limits to adaptation, SLR and loss and damage is still emerging and may be available for the AR6 WG2 report. SLR provides challenging limits to adaptation and deserves further consideration with regard to loss and damage.
16255	1	0	0	0	0	The hard work of the SROCC Chapter 1 authors is much appreciated. Most aspects listed in the approved outline are covered very clearly and comprehensively. However, some important aspects (eg SDG implications) should be elevated more specifically to the ES so that they can be used in the SPM. [Alexander Nauels, Germany]	Accepted: Thank you. We have expanded slightly our text on SDGs in section 1.1 and added a paragraph on this to the ES.
16257	1	0	0	0	0	While the emerging concept of loss and damage is introduced in Cross-Chapter Box 1, this topic can still be linked to changes in cryosphere and ocean more comprehensively in order to be discussed at a higher level. The approved outline of the report calls on Chapter 1 to provide information on limits to adaptation, a concept linked to loss and damage. Please consider establishing more clearly the link between those two concepts. [Alexander Nauels, Germany]	Taken into account: Loss and Damage was treated extensively in the Special Report on 1.5 °C. Given the short time elapsed between the SROCC and SR1.5 report release, the treatment of loss and damage in the SROCC has been limited to Chapter 1, including CCB1 on risk, briefly in Chapters 2, 5, and 6, and CCB 9. The academic literature further connecting the dots on limits to adaptation, SLR and loss and damage is still emerging and may be available for the AR6 WG2 report. SLR provides challenging limits to adaptation and deserves further consideration with regard to loss and damage.
16445	1	0	0	0	0	The chapter is well done - the "red line" is better visible in second part of chapter and may be improved in the first part - adjastment to SR1.5 is not yet uniformly made [Georg Kaser, Austria]	Noted: Thank you. References/linkages to SR1.5 have been improved for the FGD.

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17709	1	0	0	0	0	I read the chapter and I do not have anything to bring, I also think that is a complete chapter and I found the fact sheet very informative and useful [Eva Cougnon, Australia]	Noted: Thank you.
25363	1	0	0	0	0	Overall an excellent overview of OCC; encouraging to see so much on governance, resilience and on indigenous and local knowledges. However, some potential omissions and shifts in emphasis are suggested below. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: Thank you
25365	1	0	0	0	0	Overall the chapter does not frame climate change as being a wicked problem, caused largely by the model of capitalism that emphasises fossil fuel use, production, and exacerbates social inequalities in a weak sustainability model. Climate change can be considered as being the result of and further deepening inequitable access to and exploitation of resources. Fundamentally, it can be seen as a social problem. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: This is outside of the scope of the approved outline
25367	1	0	0	0	0	Because the chapter focuses more on adaptation than mitigation, it has less emphasis on the causes of climate change, proximate and ultimate, and more on consequences and some solutions. The chapter does recognise that adaptive responses will have to align with mitigation but I do feel that the emphasis could be more on addressing causes whilst supporting adaptation, at least in parts. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted. We have added an explicit section on mitigation and addressing the causes of climate change. However, the approved outline limits the extent to which mitigation solutions is covered in this report. This will be assessed thoroughly in AR6 WGIII.
25369	1	0	0	0	0	Sustainable development is mentioned at several points but is not widely interrogated as a concept in a way that could offer deeper understanding of the causes and solutions of OCC. For example, a strong sustainability model recognises the limitations of natural resources and environmental capacity to be purchased by financial capital, affecting some of the ideas presented regarding adaptive responses. Sustainable development recognises the interdependence of ecological integrity and social justice, meaning that some of the discussion of IK and LK could be explored in terms of addressing social inequalities as a route to enhanced environmental management. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: chapter 1 introduces some of these concepts but does not assess them.
25371	1	0	0	0	0	Adaptation in response to OCC has to occur in line with responses to a number of other interconnected global and local drivers. This is not always made clear in the chapter, although it is noted in a couple of places eg partly raised in p 1.23 lines 17-28. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: this is covered in the assessments within the other chapters of SROCC where appropriate.

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25373	1	0	0	0	0	There is a tendency to see 'community' as an indigenous entity, yet we see much work on sustainability action in communities across the world, rural and urban. There may not be space in this chapter, but community action enables a collective conversation and mutual learning as well as increasing individual uptake. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: "Communities" is a term used throughout Chapter 1, the framing chapter, and it is also found throughout the other 5 Chapters of the Special report. In some instances, it is used with specific types of communities (urban, Indigenous, local, coastal, etc) and in other it is stated without specifics. Because of this diverse use of the term, it would be difficult to define it in Chapter One in one set way. Were there a way to define it for this diverse use throughout the Special Report, the definition would not be in Chapter 1 but in the glossary.
25375	1	0	0	0	0	The section on indigenous and local knowledge does not include practitioner knowledge. Rangers, businessmen, farmers, foresters and many other practitioners have in depth knowledge about their roles that can also add insights to understanding and addressing climate change. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: Thank you for your comment. In fact, the expertise you mention is based on both local knowledge and scientific expertise. Therefore they come under the combination of local knowledge and scientific knowledge.
25377	1	0	0	0	0	Knowledge is considered in this report mainly as information, but knowledge is actually relational – it is invested in people and in social relationships. Learning is crucial to produce, share and implement knowledge. These aspects could be at least noted to indicate the complexity of the subjectivity of learning and action for sustainability. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Taken into Account: Thank you for your comment. We discuss and portray the figure these aspects in cross-chapter box 4. Therein you will find discussion of the process of bringing knowledge holders and their knowledge together, how coproduction, cross-fertilization, and overall complexity of the process.
25379	1	0	0	0	0	Indigenous knowledge often has a different ontological basis – integrating different ontological and epistemological perspectives is important in understanding not only how to address climate change and what it is but also in asking questions about why it arose and why we should care. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: Thank you for your comment. However it is unclear if this is a request for revision or not. We also attend to the topics you mention in cross-chapter box 4 where we describe the process in the figure of bringing together different knowledge systems.
25381	1	0	0	0	0	The rhetoric in this report has shifted to adaptation and some mitigation, but the notion of behaviour change required by all individuals, communities, businesses and practitioners is less used than before. It might be useful to have a paragraph indicating relationships between the literature on adaptive responses and on behaviour change - the latter would bring in values, beliefs and attitudes as well as shifts in structure in society and social norms. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: education and literacy are now covered in section 1.8.3.
25639	1	0	0	0	0	Consider including "Western Antarctic systems" also in the statement. There are multiple evidences to support the vulnerability of many glaciers/ice shelves like Pine Isalnd Glacier and Twaite Glacier which have accelerated dramtically in the recent decade that could initiate a larger loss of West Antarctic ice sheet to the sea. [Government of India, India]	Noted: This comment is covered in the assessment made by chapter 3

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27933	1	0	0	0	0	Given the clearly spelled out arguments in Xu et al, (Nature 2018, Global warming will happen faster than we think), the report (at least Chapter 1 and the SPM) shouild give an explicit caveat that the assumed upper limit of RCP8.5 (and resultant temperatures) may be passed within this century and therefore indicate that the stated upper limits in this report are arguably on track to be exceeded for 2100. [Lev Tarasov, Canada]	Taken into account: In CCB1 we now say that current emmissions are following a pathway similar to RCP8.5, but we don't assess beyond this.
28443	1	0	0	0	0	For SIDS, the concept of Loss & Damage is very important and we are happy to see it being introduced here. The coverage of this topic throughout the report is not satifactory and the references to other chapters and related issues like limits to adaptation should be more clearly established and explained. [Government of Saint Lucia, Saint Lucia]	Taken into account: Loss and Damage was treated extensively in the Special Report on 1.5 °C. Given the short time elapsed between the SROCC and SR1.5 report release, the treatment of loss and damage in the SROCC has been limited to Chapter 1, including CCB1 on risk, briefly in Chapters 2, 5, and 6, and CCB 9. The academic literature further connecting the dots on limits to adaptation, SLR and loss and damage is still emerging and may be available for the AR6 WG2 report. SLR provides challenging limits to adaptation and deserves further consideration with regard to loss and damage.
30523	1	0	0	0	0	Congratulations to the author team. This nice framing chapter was really thoroughly prepared and follows a clear and logic structure; it is concisely written and uses clear language; the many cross-references within the chapter (to other sections) is quite useful; the chapter thoroughly explains the context of the report and provides a perfect frame linking to all the following chapter. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Thank you for the encouraging feedback.
23321	1	0	0	0	0	I congratulate the authors for the quality of the second order draft. I have provided comments to the SPM that are relevant for executive summaries of all chapters. Chapter 1 could improve the value of the chapter in providing the "big picture" (e.g. characterstic time scales, irreversibility), and strengthen its value as a "travel guide" across the other chapters. Trends in exposure could be also relevant to be explicitely treated in chapter 1 (not just how many people live today in some contexts, but trends). [Valerie Masson-Delmotte, France]	Accepted: Thankyou, the chapter has been revised to include these aspects
1351	1	0	0	74		"Chapters 2-6 of the SROCC" is a longer and no more informative way of saying "this report". [Jacinta Clay, United States of America]	Noted.
4307	1	0	0	0		This is a very well written chapter. Congratulations. [The UBern Team Group Review, Switzerland]	Thank you
4317	1	0	0	0		Not only infrared radiation excapes to space, also reflected shortwave radiation. [The UBern Team Group Review, Switzerland]	Thank you for this comment. The figure has been revised and we left all fluxes out and displayed only the changes of the cryosphere.

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21899	1	0	0	0		In this Framing Chapter- there is no synthesis of how Disaster Risk reduction (DRR) can be better integrated with Climate Chanage Adaptation processes. Such joined-up approaches are emerging on the back of the Senadi Framework but there are still much siloed thinking, which could be helped by some framing in Chapter 1 e.g. how the slow onset rise in risk from SLR interests with civil-defence-emeregncy management appraoches to reduce risk (which are often focused on present-day risks from rare, large-magnitude hazard events rather than future cumulative effects -also how national climate risk/vulnerability assessments can doevtail with DRR. One example is: Mysiak et al. (2018). Brief communication: Strengthening coherence between climate change adaptation and disaster risk reduction. Natural Hazards Earth Systems Science, 18: 3137-3143. https://doi.org/10.5194/nhess-18-3137-2018 [Robert Bell, New Zealand]	Accepted -- Thank you very much for this very helpful comment. This aspect has been taken up in the governance section of chapter 1, framing the challenges. Chapter 1 is not meant to be a synthesis chapter, though.
26891	1	0	0	0		This chapter is in getting shape, congratulations to the Chapter team. Justification of this report is well established. But, the urgency of action to mitigate the causes, drivers of changing ocean and cryosphere seems relatively weak. [Golam Rasul, Nepal]	Noted. We have added an explicit section on mitigation and addressing the causes of climate change. However, the approved outline limits the extent to which mitigation solutions is covered in this report. This will be assessed thoroughly in AR6 WGIII.
30605	1	0	0	0		Chapter might become more punchy by developing synthetic statements across chapters as indicated by comments on ES bullet points. These might then qualify for a more punchy SPM. [Hans-Otto Poertner and WGII TSU, Germany]	Noted: The ES has been revised extensively taking into account comments
15425	1	0	1	0		General Comment: report outline and storyline The chapter should begin (not end!) with a section that combines the 'storyline' (currently in Section 1.10) and chapter overview - including an explanation of the value added by this chapter. In short, the reader should know at the start how the different sections of the report fit together, and why they should read Ch1 rather than go directly to the specific chapters of greatest interest. [EUCE, Belgium]	Rejected: This has been considered but we prefer to start the chapter framing the importance of the ocean and cryosphere, and to end the report with a link to the following chapters through the storyline.
13705	1	1	0	73	0	GENERAL COMMENT: The chapter is currently significantly over the page limit and needs to be shortened. Sections 1.5 and 1.6, for example, could be distilled down to key points and it is suggested that the authors ensure that it is always relevant to oceans and the cryosphere. Often there are more general discussions, sometimes without any clear messages on how it relates to oceans/cryospheres. Also, descriptions of what's contained in sections of the report can be cut down/removed and put in one place, possibly combined with the section on the storyline. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted. The main text was 16% over-length. Length has been reduced and sections 1.5 and 1.6 revised extensively.
13707	1	1	0	73	0	GENERAL COMMENT: Suggest that the framing of text around mitigation and adaptation is looked at again. At times, it reads as though adaptation is the key to reducing impacts, and almost neglects, or reduces to a side point, that reducing emissions in the first place will lessen impacts. Specific examples are pointed out below. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into consideration. The structure has been revised and mitigation is explicitely mentioned in new subsection "1.6.1 Mitigation and Adaptation Options in the Ocean and Cryosphere". Note that the indicative outline limits mitigation to blue carbon.

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13709	1	1	0	73	0	GENERAL COMMENT: throughout the chapter it says what was in AR5 but it's not always explicit whether information has changed since that report. There's a risk that readers take the AR5 values to be the latest understanding/numbers and ignore updated numbers in SROCC which are found elsewhere. Worth looking at these sections again to make clear where the AR5 values are still the latest or where the SROCC has updated understanding (pointing out to relevant chapters instead of repeating it in this chapter). [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted: This comment applies in particular to section 1.4. We have added text to make it clear that Chapter 1 provides the point of departure (AR5, or SR15).
13711	1	1	0	73	0	GENERAL COMMENT: The FAQs don't seem to be questions that are frequently asked in relation to oceans and the cryosphere and it seems to be a missed opportunity to include something short and snappy that appeal to a general audience. Questions such as (for example) "can we reverse changes to the oceans?" or "how are climate change and ocean acidification related?" or "when will we reach an ocean tipping point?" seem more of interest to people. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected: The selection of FAQs are through a process of survey. The questions asked here are generic in nature to cater to a very general auidence.
13713	1	1	0	73	0	Acronyms are used throughout the chapter without being defined at their first use. This needs to be checked and amended throughout the chapter. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted: This will be corrected in the final version, thank you
2605	1	1	0	73		I feel authors nicely written this chapter and so no more ammendments are required. [Pushp Raj Tiwari, United Kingdom (of Great Britain and Northern Ireland)]	Thank you
34237	1	1	0	73		General: The chapter objective is framing the context. However, the chapter includes some conclusions and findings. It is hard to follow since the findings respond more to the subsequent chapters. Perhaps, could be good to reduce the load on the findings in the chapter and concentrate more on the framing and the structure of the report. As well as on defining the common concepts that are used all across the SR. [Maria Jose Sanz Sanchez, Spain]	Taken into consideration. In the FGD, we almost exclusively provide the point of departure, mostly based on AR5 and SR1.5.
10807	1	1	1	54	41	Can the relevance, utility and comparative strengths of IK and LK be expected to be greater in the cryosphere of the higher latitudes than in other environments?. This could be for two clusters of reasons: first that the more extreme seasonal changes combine with potential continuous observation by those who live in the high latitude cryosphere. Second, observations will be sharper because so important for survival in the difficult environment in which people have to contrive their livelihoods, much of these dependent on hunting and fishing? [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Noted but we are not aware of any literature that does this type of comparison. Furthermore chapters 2 and 3 have not assessed this. Therefore, without a specific reference suggested by the reviewer we are unable to elaborate on this comparison

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29027	1	1	1	69	35	Do want to note that this in large part is an exceptionally clearly written and above all, useful chapter for policy makers; I plan to direct them to this section of the final report to clarify a number of difficult concepts relating to oceans and cryosphere. [Pam Pearson, Sweden]	Thank you.
25881	1	1	1	73	8	Terminology glaciers: the term mountain glacier should be avoided since this narrowly refers to a specific type of glaciers. Following AR5, 'glaciers' should be used for all land ice masses that are not ice sheet. So, the 2 types of land ice to distinguish are 'ice sheets' and 'glaciers'. [Regine Hock, United States of America]	Accepted: This has been corrected in consultation with chapters 2 and 3, thank you
25919	1	1	1	73	8	General structure: The chapter does a great job setting the stage for the chapters to come, introducing basic concepts and terms and the importance, and the boxes are excellent in that regards, however the chapter would gain from 'less', i.e. greatly reducing or even eliminating some subsections, as well as minor restructuring. I suggest to move Sec 1.9 and 1.10 after Sec 1.3 since these sections provide highly relevant information for understanding the logic of the report, while much in the 'middle' sections in between is info found in the chapters later (e.g. 1.4-1.7) and could be reduced. In fact I found these section quite 'painul' to read since they often only touch on topics with little 'real' information and have endless section references. These sections may be more useful for a reader if they were reduced to introducing basic concepts and terminology used in this report. There is also quite a deal of repetition which should be avoided. [Regine Hock, United States of America]	Noted: The structure has been extensively revised and the titles of sections and subsections made more explicit. However, we kept the "methods" sections toward the end of the document so that they do not alter the flow above. Also, it is common practice to provide the storyline at the end.
25941	1	1	1	73	8	Ther is way too much cross-referencing to the later chapters. It seems like that whenever a term comes up that also aopears in other chapters there is a cross-reference. That makes it hard and cumbersome to read and in many of these cases I don't think this is needed especially when there are endless lists such as on page 37 Lines 26, or 28 or 31 or 41. The basic structure of the report is clear from tthe table of contents and more restrictive use of cross-referencing will make the report more readable. [Regine Hock, United States of America]	Taken into account: we have considered this in our cross referencing of the FGD
9473	1	1	2	1	2	We suggest to make use of this framing chapter to introduce definitions used later in the report such as the criteria selected to define a « coastal population » ? Where does the « 100 km from coast and less than 100 m elevation » found in Figure SPM.1 come from ? [Government of France, France]	Noted: The source (Kummu et al., 2016) is given in the second paragraph of section 1.1. We now also explicitly discuss the LECZ as well.
26825	1	3	0	10		Why is most of this text devoid of confidence statements? Much of the text is not accepted fact. [Ko Barrett, United States of America]	Accepted: we have worked to provide confidence statements in the ES where neccessary
22985	1	3	0	3		Please report what does on unabated and what is accelerating (sea level). [Valerie Masson-Delmotte, France]	Noted: We no longer have this wording in the revised ES. The SPM specifically notes which changes are becoming more rapid (A.2)

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1323	1	3	0	4		I believe the claim here "Vulnerabilities to risk lead to direct and indirect impacts on natural systems; for example, about half of species assessed on the northeast United States continental shelf exhibited high to very high climate vulnerability (Hare et al., 2016)" is significant enough to be cited in the executive summary. It's a statistic that scientists, science journalists and non-scientists reading the report would all likely be interested in. [Jacinta Clay, United States of America]	Noted. We agree that this is a significant finding. While it did not (ultimately) make it to the final version of the Executive Summary, the more general recognition of significant negative consequeneces for physical, chemical, and biological aspects of the ocean and cryosphere are highlighted.
30575	1	3	1	0		The executive summary gives a nice general, mostly qualitative overview but would be more punchy if key findings could be detailed (specified and quantified), also and especially with respect to solution options by adaptation and mitigation efforts. ES could be made more punchy by specifying statements on climate, impacts, adaptation and adaptation limits. This would also help the development of the SPM as a stand-alone document. I have indicated where such question marks come up when reading the present ES. If quantitative statements are not possible for global scale they may still be possible for key regional examples (case studies). Providing semi-quantitative estimates or orders of magnitude would also help to understand better and e.g. differentiate between whether projected mean global or regional changes are by e.g. 5 or 95 %. Some stream-lining may be possible by excluding statements of the obvious that cannot be specified or quantified or cannot specify gaps of knowledge. This may also apply to the main body of the text. [Hans-Otto Poertner and WGII TSU, Germany]	Rejected. The task of chapter 1 is to frame rather to provide quantitative assements. We have however worked to make the ES more punchy and integrated with the key messages of the SPM.
2397	1	3	1	3	37	Unfortunetaly my comment on the FOD was ignored. Once again, the Executive Summary fails to mention and detail the pre-industrial climate historical context. A large number of palaeoclimate reconstructions have been published which document significant natural variability both for the oceans and cryosphere on decadal to millennial time scales. This enlarges the short observational period enormously by adding crucial palaeoclimatic context. It is in the spirit of full transparency that this enormous natural variability has to be acknowledged, together with the fact that climate models still struggle to fully replicate it. It must not be concealed that the poor hindcast model performance is a matter of concern and decreases confidence into model skill and future prognosis capability. [Sebastian Luening, Portugal]	Noted: This comment from the FOD was considered in the preparation of the SOD, and in response palaeoclimate perspectives were elevated in a number of places in the main text of chapter 1. Specific assessments of the context that palaeoclimate data gives to ocean and cryosphere change are to be incorporated in the assessment chapters where relevant.
17479	1	3	1	4	37	Mention somewhere in the Executive Summary (maybe in the discussion of how much warming has happened already, 1-3, L27–36) how close we are to 1.5 ºC, which according to the IPCC 1.5C Special Report is 2032 to 2050, though it could be even sooner (Xu Y., et al. 2018, Global warming will happen faster than we think, Nature Comment.). [Kristin Campbell, United States of America]	Taken into account: this has been addessed in revisions to the ES and section 1.1

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32345	1	3	1	4	37	Compound nouns (joining verbs, adjectives and nouns together to form a noun made of many words) make this executive summary difficult to understand. Words such as 'change' and 'impact' are verbs as well as nouns. When used as the last word of a compound noun then they appear to be used as verbs. Often, a sentence will require reading twice to get the correct meaning. This will make it very difficult for most people, especially those with English is their second, third or fourth language. For ease of reading by policy makers, I recommend that rules be applied to govern the use of compound nouns to avoid translation difficulty - or identify compound nouns at the top of the Executive Summary and use them consistently. I would prefer 'impacts from' and 'changes of' or 'changes in' as an alternative approach. [Andrew Constable, Australia]	Taken into account: the wording of the ES has been extensively reviewed and revised.
52	1	3	3	3	7	This statement of purpose is extremely wordy and not fully consistent with the content of the chapters. Please improve. [Baylor Fox-Kemper, United States of America]	Noted: the paragraph has been revised and re-focussed on this chapter
1537	1	3	3	3	7	I am still not sure what the clear "unique selling point" of the SROCC is. The SR15 has done a great job in explaining the main impacts of climate change at different global warming levels. Should the SROCC expand on the SR15 by providing more detail of changes in the ocean and cryosphere at 1.5 and 2 degC? Or does it seek to provide a more "traditional" assessment with more detail on oceans and cryosphere than will be found in the main AR6 assessment reports? Is it perhaps more about vulnerability and adaptation for unmitigated scenarios? Is the main USP the combination of WGI and WGII science? Clarity about the main thrust of the report would help the ES statements and the SPM, I think. The focus can be sharpened. [Matthew Collins, United Kingdom (of Great Britain and Northern Ireland)]	Noted: The SPM storyline has been improved and addresses this comment
54	1	3	3	4	70	There is very little quantitative information here. Please bring forward key quantitative metrics, e.g., rates of warming, sea level rise, % mass loss of Greenland, Antartica, and sea ice & relevant uncertainties. [Baylor Fox-Kemper, United States of America]	Noted: Quantitative metrics are assessed within the other SROCC chapters and it would introduce duplication if they were also given in chapter 1. Presenting metrics from AR5 would add confusion to the new assessments that follow in the chapters. The quantified assessments from the chapters will be highlighted in the SPM also.
1259	1	3	5	0	6	I would suggest saying "Oceanic and cryospheric responses to climate change compound the risks…" instead of "Climate change-related impacts on the ocean and cryosphere compound the risks". I found the original difficult to follow (at least while skimming) and this also shaves off two words. [Jacinta Clay, United States of America]	Noted: This paragraph has been rewritten
30301	1	3	5	3	5	Please don't use a stand-alone pronoun and leave its antecedent ambiguous. I suggest changing "how this alters" to "how these changes alter" [Paul Glaser, United States of America]	Noted: This text is no longer in the ES

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5569	1	3	5	3	7	The statement that " most mitigation and adaptation measures implemented at the local-scale have co-benefits and few tradeoffs, but do not present global-scale solutions to climate change mitgation" seems a surprising statement especially related to adaptation since trade-offs will inevitably made at the local level. THis statement seems poorly connected to the rest of the sentence as the reason for saying " do not present global-scale solutions to climate mitigation". Could this sentence be simplified with one idea in it instead of a mixture of thoughts. It is not a clear statement and thusis confusing to the reader. [Judy Lawrence, New Zealand]	Accepted. Trade-off replaced by disbenefits.
11725	1	3	5	3	7	The statement that " most mitigation and adaptation measures implemented at the local-scale have co-benefits and few tradeoffs, but do not present global-scale solutions to climate change mitgation" seems a surprising statement especially related to adaptation since trade-offs will inevitably made at the local level. THis statement seems poorly connected to the rest of the sentence as the reason for saying " do not present global-scale solutions to climate mitigation". Could this sentence be simplified with one idea in it instead of a mixture of thoughts. It is not a clear statement and thus is confusing to the reader. [Judy Lawrence, New Zealand]	Repeated comment. See response to comment #5569
23597	1	3	6	3	6	The "nature" sounds imprecise in the context here, but may refer to species. Ocean and cryosphere are also elements of nature (i.e., physical dimensions of it). Perhaps, "how this alters the services that the ocean and the cryosphere provide to people, and the functioning and abundance of the related natural systems ..." [Government of Sweden, Sweden]	Noted: We now use "ecosystems and people"
1261	1	3	9	0	18	The statistic of the population living high mountain area is less useful than a similar statistic about the percent of people who depend on glacier water or live within an area irrigated by a flood plain. An article with such a statistic is... Kaser, Georg, Martin Großhauser, and Ben Marzeion. "Contribution potential of glaciers to water availability in different climate regimes." Proceedings of the National Academy of Sciences (2010). It is older than the intended window for research but perhaps more relevant [Jacinta Clay, United States of America]	Noted: this publication has been cited in section 1.1, as well as a specific example from recent literature based on the Indus and Ganges basins.
17475	1	3	9	3	18	Add that changes in the Arctic region can impact those outside of the Arctic through teleconnections and weather disruptions/increases in extreme weather. [Kristin Campbell, United States of America]	Noted: this is covered in the assessment of chapter 3
17575	1	3	9	3	18	Add that changes in the Arctic region can impact those outside of the Arctic through teleconnections and weather disruptions/increases in extreme weather. [Durwood Zaelke, United States of America]	See response to comment #17475
23601	1	3	9	3	18	Here, it should be expressed that the ocean and cryosphere are unique systems that have intrinsic value as such, including the ecosystems and biodiversity they support. [Government of Sweden, Sweden]	Accepted: This has been added to section 1.5
4943	1	3	10	3	10	This sentence can do without 'multitude of' as 'systems' already imply 'many'. [Debra Roberts and Durban Team, South Africa]	Accepted: wording has been revised

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16637	1	3	13	3	13	I wonder on the focus on "rainfall" here. It seems odd, in between climate regulation (which encompasses rainfall among other atmospheric drivers) and water supplies (which also encompasses rainfall somewhat). If rainfall is mentioned explicitely here, why not mention "precipitation" (which includes snowfall too), or other meteorological/atmospheric fields like temperature, radiation, wind, humidity ? [Samuel Morin, France]	Taken into account: wording is more explicit in revised ES
23599	1	3	13	3	13	"Rainfall" may not be needed here, as it is quite basic that rainfall involves the oceans (which is also true to a large part of the global-scale heat transport from the tropics towards the poles, mildness of maritime climates, ...). [Government of Sweden, Sweden]	Taken into account: wording is more explicit in revised ES
5227	1	3	13	3	14	I suggest add: " All people on Earth rely on the ocean and cryosphere for the climate regulation, rainfall, food and water supplies, renewable energy, and trade and transport they support, and the same for biodiversity living in these latitudes,. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Noted, however many of the things in this list are specific to people and do not benefit biodiversity.
28311	1	3	13	3	14	replace the end of the sentence by energy, trade and transport. (delete support, this is nor the right word to use) [Anne GUILLAUME, France]	Accepted: wording has been revised
30561	1	3	13	3	14	This list comes across as exhaustive, but it is not. Suggestion to either address aspects of all ecosystem services (including cultural) or indicate these are examples. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: we say these services "include"
18351	1	3	14	3	15	I think it would be better to highlight the level of risk such as high risk or moderate risk at the end of the statement. [APECS Group Review, Germany]	Noted: we do not assess level of risk in chapter 1. A confidence statement has been added, but we have not qualified level of risk
17261	1	3	14	3	18	In relation to the cryosphere in particular, Arctic communities and peoples whose lives and livelihoods are tied to the ice, for example Inuit, have been facing particular challenges over the past decades. Arctic communities and Arctic Indigenous Peoples should be specifically mentioned here in relation to the cryosphere as their physical, mental, and economic well-being are dpendent on the ice. [Joanna MacDonald, Canada]	Noted: this is true, but is specifically relevant to the assessment in chapter 3 rather than the framing of the whole report. We cover this also in 1.5, but do not feel that it should be in the ES of chapter 1.
30577	1	3	15	0		Can overarching risk thresholds, e.g. low to medium, medium to high etc.) be identified by drawing together information from the diverse chapters? [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: this is the role of the SPM, not of chapter 1
5571	1	3	15	3	16	This sentence correctly suggests that local-adaptation provides space for communities to respond to climate change and thus is contradicted by the confusing statement in comment #1. [Judy Lawrence, New Zealand]	Taken into account: the source of the confusion has been dealt with (
26809	1	3	20	0	21	This seems to cross the line in terms of being policy neutral. IPCC should not be seen endorsing actions in accordance with the Paris Agreement. [Ko Barrett, United States of America]	Accepted: wording has been revised to be policy neutral
4945	1	3	20	3	21	The SR1.5 (SPM D.1) indicated that current commitments under the Paris Agreement are not enough for the emission reduction required to avoid a 1.5°C warmer world. This HS needs to be aligned to the SR1.5 [Debra Roberts and Durban Team, South Africa]	Accepted: wording of ES statement has been revised extensively.
16639	1	3	20	3	21	This statement sounds very prescriptive. [Samuel Morin, France]	See response to comment #26809
32805	1	3	20	3	21	This sentence is not policy-neutral. It may be a matter of opinion whether and to what degree there is urgency, and from what standpoint. Suggest removing the sentence. [Government of United States of America, United States of America]	See response to comment #26809

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
13715	1	3	20	3	22	This sentence could be written in a more direct way. "place urgency on" sounds a little strange. Also, this is an important point that should be clearly reflected in the SPM. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted: wording of ES statement has been revised extensively.
188	1	3	20	3	25	The statement would imply that if the temperature target of Paris is achieved it would safeguard the Ocean and Cryoshpere environment. The question is where there will be a need for adaptation and how large. In contrast on page 4 lines 1-2, it is suggested that urgent efforts to teduce GHG emissions are not a substitute for adaptation measures. There may be a need to further clarify the earlier statement. [Mustafa babiker, Saudi Arabia]	Accepted: wording of ES statement has been revised extensively.
4947	1	3	20	3	25	The supporting text does not seem to talk to the HS. [Debra Roberts and Durban Team, South Africa]	Accepted: wording of ES statement has been revised extensively and HS now matches the rest of the text in the bullet on characteristics of change
17477	1	3	20	3	25	Add that 1.5 ºC (or 2 ºC) of global warming means double (or more) in the Arctic, which is why it is susceptible to dangerous impacts and the site of multiple feedbacks and tipping points. 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; and Steffen W., et al. (2018) Trajectories of the Earth System in the Anthropocene, PROC. NAT'L. ACAD. SCI. 115(33):8252–8259. [Kristin Campbell, United States of America]	Duplicate comment. See response to comment #17577
17577	1	3	20	3	25	Add that 1.5 ºC (or 2 ºC) of global warming means double (or more) in the Arctic, which is why it is susceptible to dangerous impacts and the site of multiple feedbacks and tipping points. 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; and Steffen W., et al. (2018) Trajectories of the Earth System in the Anthropocene, PROC. NAT'L. ACAD. SCI. 115(33):8252–8259; Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Durwood Zaelke, United States of America]	Noted: Arctic amplification is covered in chapter 3 and the SPM
17579	1	3	20	3	25	Mention somewhere in the Executive Summary (maybe in the discussion of how much warming has happened already, 1-3, L27–36) how close we are to 1.5 ºC, which according to the IPCC 1.5C Special Report is 2032 to 2050, though it could be even sooner (Xu Y., et al. 2018, Global warming will happen faster than we think, Nature Comment.). [Durwood Zaelke, United States of America]	Duplicate comment see response to # 17479

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
13717	1	3	21	3	21	"temperature targets of the Paris Agreement". Should read "temperature goal of the Paris Agreement". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted, minor edit
30563	1	3	21	3	21	A clearer reference to the Paris Agreement could be made here, including mentioning the 1.5°C and 2°C degrees limits. I would also suggest to omit the "temperature targets" because of its connotation ("limit" has been identified as the more appropriate term). [Hans-Otto Poertner and WGII TSU, Germany]	Noted: we no longer mention the Paris Agreement in the ES
30579	1	3	22	0		specify systems [Hans-Otto Poertner and WGII TSU, Germany]	Noted: this text is no longer in the ES
25873	1	3	22	3	22	Is 'dangerous' the best term here (also elsewhere in the text). what's 'dangerous' impacts? Dangerous for what and who? [Regine Hock, United States of America]	Accepted: "dangerous" has been omitted in most instances, except where it is used in the context of UNFCCC
30581	1	3	24	0	25	Can a figure with overarching risk thresholds, e.g. low to medium, medium to high etc.) be prepared by drawing together information from the diverse chapters to support these general statements? [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: this is the role of the SPM, not of chapter 1
27089	1	3	24	3	24	Would it be better also to include natural systems? [XIAOMING WANG, Australia]	Accepted: we have added "and ecosystems" following human societies.
30583	1	3	27	0	28	This statement is clear and does not really add to the ES [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: wording has been changed and we now only give with SR1.5 level of current warming within a ES bullent (not a headline statement)
22889	1	3	27	3	28	The statement: "Unequivocal climate warming, that AR5 assessed as extremely likely2 attributable to human-induced greenhouse gas emissions, has so far resulted in global average warming..." is not true. It has not been documented that the climate change /warming) is due to human-induced greenhouse gas emissions alone. Most of the warming is a result of natural variance. [Martin Hovland, Norway]	Rejected: The suggestion that most of the current warming is a result of natural variance is not supported by scientific literature. The statements made here are based on the AR5 assessment, which sets the stage for the context of the SROCC report.
30565	1	3	27	3	30	Suggestion to rephrase: Unequivocal climate warming, attributed extremely likely to human-induced greenhouse gas emissions in AR5, has so far resulted in a likely rise of global average temperatures by 1°C ± 0.2°C since the pre industrial period, accompanied by ongoing and accelerating changes in the ocean and cryosphere. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: thank you for the helpful suggestion. The ES wording has been revised extensively.
29017	1	3	27	3	36	In this very excellent and well-written introductory section (more likely to be read by policy makers reading just the SPM and skimming the main SR) it is important to introduce the concept that climate change is occuring more rapidly in these regions, with temperatures increasing at double or (in a few outliers) even triple the global rate of warming cited here. This emphasizes also the special vulnerabilty of polar and high alpine regions. [Pam Pearson, Sweden]	Noted: Arctic amplification is covered in the SPM.
4349	1	3	28	3	28	Clarify that 1°C warming relates to global atmospheric surface temperature changes and not to SST changes. [The UBern Team Group Review, Switzerland]	Noted: We use the wording of SR1.5
4949	1	3	29	3	29	Add 'has' before 'been accompanied' [Debra Roberts and Durban Team, South Africa]	Noted: The wording of this ES statement has been extensively revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23603	1	3	29	3	29	Suggest "likely range", rather than just "likely". [Government of Sweden, Sweden]	Noted: The wording of this ES statement has been extensively revised.
24313	1	3	29	3	29	The use of likely here seems incorrect, as it is not about a statement in the future, but actually observed global warming in the past. Instead of a likelihood statement, a confidence statement would be more approriate. I would suggest high agreement, robust evidence [Philippus Wester, Netherlands]	Noted: wording is based on the assessment made in SR1.5 that sets the context for the SROCC report.
28259	1	3	29	3	29	The causal link between global warming and the impacts on the ocean and cryosphere does not become clear enough in my opinion when using 'accompanied'. According to this phrasing, there could also be a common cause for both of them. I would suggest: '...the preindustrial (likely). Warming and increasing GHG concentrations have led to ongoing and accelerating changes in the ocean and cryosphere.' [Benedikt Ehrenfels, Switzerland]	Noted: The wording of this ES statement has been extensively revised. Attribution is part of the assessment of the chapters.
25875	1	3	30	3	36	confidence assessment missing [Regine Hock, United States of America]	Accepted: confidence language has been added
30567	1	3	31	3	32	Can be spelled out more clearly for non-specialists what it means that "projections of earlier assessments have since been confirmed, or continue to develop at the upper, more extreme end of past projections"? The combination of information about the development in models and actual observations in this paragraph might otherwise be difficult to understand. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: wording has been revised to make paragraph clearer, and additional text also added to section 1.4 and SM1.1 Table 1
30585	1	3	32	0	36	Could be a separate introductory bullet point, complemented by the respective numbers since pre-industrial. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: numbers since pre-industrial are part of the assessment of the chapters. Bullet has been made more specific, including confidence language from AR5 and SR1.5
16641	1	3	32	3	32	"Since AR5" should be made clearer whether this refers to events that occurred since 2013/2014, or evidence/results published since 2013/2014 (and may refer to changes and phenomena that occurred earlier). [Samuel Morin, France]	Taken into account: wording has been revised extensively to make messages clearer here
16643	1	3	32	3	32	In this "framing" chapter, I think we do not expect assessments of literature since AR5, but a summary of AR5 results providing the basis for what needs/needs not be updated. [Samuel Morin, France]	Rejected: Assessments of new literature on physical changes are not in chapter 1, but chapter 1 does need to set the stage for the wide-ranging changes that make the SROCC report important. This overview cannot be provided by any chapter other than chapter 1 due to the constraints (geographical or process-based) of all of the other chapters.
5229	1	3	33	3	33	I propose add: " ....include warming, acidification and deoxygenation of the ocean, and Arctic sea ice and permafrost decline, following by biodiversity lost joint with the human overexploitation. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Rejected: this ES point is focused on physical changes only. Natural changes, and combined pressures are covered in other parts of the report.
16645	1	3	34	3	34	I think reduction of Northern Hemisphere snow cover extent was well featured in AR5 and would make a nice addition to this list especially given that it is not assessed in SROCC although part of the cryosphere. Good as a framing information, even if not part of the assessment. [Samuel Morin, France]	Accepted: this has been added to the ES and to section 1.4.2
28313	1	3	38	3	38	"compound" may be the right word but in my view to sofisticated for a non British reader, replace may be by "worsen", "enhance", "add" or a synonym [Anne GUILLAUME, France]	Accepted: we don't use this word anymore

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4351	1	3	38	3	40	This sentence is difficult to understand for non-specialist. Especially the term 'compound' may not be familiar to everyone. The word 'amplify' could be used instead of 'compound' [The UBern Team Group Review, Switzerland]	Accepted: we don't use this word anymore
27091	1	3	38	3	40	The statement has addressed too much on risks (negativity) of climate change. It should be pointed out that the change may also provide opportunities (positivity) as well. The lack in addressing two aspects may give an impression of biases. It is also worth noting that climate change-related natural hazards are not only the aspect leading to risks, the deterioration of services (ecosystem services and cryosphere services) would also create risks, which were not properly addressed so far. [XIAOMING WANG, Australia]	Taken into account: we no longer have this headline statement anymore. Possible opportunities are discussed in the chapter text.
30569	1	3	38	3	40	If aspects of vulnerability, adaptation, risk reduction and sustainable development could be included in the first sentence, it would better reflect the rest of the paragraph. Another option might be to address impacts, stressors and vulnerabilities in this paragraph and adaptation and sustainable development in the following one. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: We have added a seperate paragraph of sustainable development.
4951	1	3	38	3	45	The supporting text does not seem to talk to the HS. [Debra Roberts and Durban Team, South Africa]	Accepted: this paragraph has been extensively revised and text on vulnerability and exposure is now in paragraphs 2 and 3 of the ES
16447	1	3	38	3	45	The paragraph is quite (too) general and would be valid for any society and for any kind of threat. [Georg Kaser, Austria]	Accepted: this paragraph has been extensively revised and text on vulnerability and exposure is now in paragraphs 2 and 3 of the ES
30587	1	3	40	0	45	This text should be specified for this report, i.e. are there specific adaptation measures that characterize or facilitate life in cryosphere and ocean regions? [Hans-Otto Poertner and WGII TSU, Germany]	Noted: paragraph revised extensively. We frame adaptation measures in the text, but specific assessments for ocean and cryosphere regions are relevant to the chapters. Chapter 1 cannot elevate any specific measure in the ES
23605	1	3	40	3	40	It is not readily clear how adaptation reduces hazards (such as extreme events) as such. Could this be redrafted? [Government of Sweden, Sweden]	Accepted: this text has been extensively revised.
27093	1	3	40	3	40	In climate system, natural hazards may not be reduced. This needs a bit more clarification. [XIAOMING WANG, Australia]	Accepted: this text has been extensively revised.
22699	1	3	40	4	2	The sentence line 40 to 41 which only highlights the need for Adaptation to reduce risk. There needs to be a preceeding sentence that highlights the urgent need to act on climate mitigation AND adaptation. Currently p4 line 1-2 sentence is narrow in focus on ocean and cryosphere mitigation. Therefore without a sentence in paragraph starting line 38 of p3, the current order may be interpreted as undermining the importance of reducing greenhouse gas emissions, which is equally if not predominantly important to adaptation needs and not taking into account of the importance of holistic mitigation efforts beyond oceans and cryosphere [Greeenpeace Group Review, Republic of Korea]	Accepted: this text has been extensively revised. We do also highlight the need for mitigation and adaptation in a different ES paragraph
26903	1	3	41	3	41	Not sure whether this is correct " Adaptation efforts reduce risk by redicing hazards". Better to revise the sentence. [Golam Rasul, Nepal]	Accepted: this text has been extensively revised.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5231	1	3	41	3	42	I suggest include: "The vulnerability of people to ocean and cryosphere change, and their adaptive capacity, is shaped by social, political, cultural, economic, environmental, institutional, geographical, and demographic factors. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted: this text has been extensively revised.
26905	1	3	41	3	42	I think, technologicy also important for adaptive capacity. [Golam Rasul, Nepal]	Accepted: this has been added
25877	1	3	43	3	43	why only high confidence: seems like a textbook like statement that is true ('can be supported ....') [Regine Hock, United States of America]	Noted: this text has been extensively revised
5161	1	3	45	0		Include the need for social justice and equity as well (as outlined in SR1.5). [Debra Roberts and Durban Team, South Africa]	Agreed
522	1	3	47	3	47	This is addressing FOOTNOTE 1. Is is possible to rewrite 'virtually certain' as 'exceptionally likely'? I know these terms stem from earlier reports, but it seems a bit misleading to say virtually certain, but not virtually uncertain and vice versa. Exceptionally unlikely seems more certain than virtually certain seems uncertain. [Jenna Pearson, United States of America]	Noted: This is standard usage that is common to all IPCC reports, so cannot be changed for this report. Such a change would require coordination and agreement across the IPCC working groups.
30589	1	4	1	0		Can adaptation limits be identified? [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: this is part of the chapter assessments
22987	1	4	1	4	1	More substance is needed on the scale of committed responses (key input to SPM). [Valerie Masson-Delmotte, France]	Taken into account: we have revised this ES paragraph to emphasise the characteristics of change, but not focused on the magnitude of committed change (this is part of the assessment rather than framing)
26277	1	4	1	4	1	Suggest that "the use of adaptation measures" be "the use of global-scale adaptation measures". This will be consistent with I believe is the intention in lines 5 to 7. [Zelina Ibrahim, Malaysia]	Rejected: many of the adaptation measures are local.
26907	1	4	1	4	1	I think, better to replace " commited" with Observed and projected [Golam Rasul, Nepal]	Rejected: committed conveys the message that there are some changes that are now "unstoppable". This is different to just refering to projected changes.
24639	1	4	1	4	2	the title of this summary paragraph (the text in bold) needs to be clarified or re-worded.. E.g.what is a committed ocean and cryosphere change? The sentence seems confused. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: this is now explained in clearer wording in the paragraph on characteristics of change
30571	1	4	1	4	2	If co-benefits, trade-offs and limitations could be mentioned in the first sentence, it would better reflect the content of the paragraph and be less prescriptive. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: the paragraph has been revised extensively, including the headline statement and the comment doesn't apply anymore.
524	1	4	1	4	9	Please list a few examples of global and local mitigation strategies, or at least a major difference between the two. [Jenna Pearson, United States of America]	Rejected: we are unable to expand on this in the ES, but we give details in Figure 1.2
27095	1	4	3	4	4	The listed measures could only be considered as examples, not include all. [XIAOMING WANG, Australia]	Rejected: Note that we do not list measures but the broad categories of measures. Details are provided in Fig. 1.2 and SM1.3.

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23607	1	4	4	4	5	The Chapter (section 1.6) would not seem to provide discussion or references to support this statement, nor the confidence level. As this is quite important, it would be good to provide the assessment itself (or section references, if an assessment is written down elsewhere) to support this finding. In addition, an idea on the size of such mitigation potential might be useful, for perspective. [Government of Sweden, Sweden]	It is not clear which statement the reviewer refers to. lines 4-5 do have a confidence statement and the supporting reference is given in section 1.6.
30303	1	4	4	4	7	: Can this sentence be broken up so it does not span seven lines of text? [Paul Glaser, United States of America]	Taken into account: paragraph has been revised
30591	1	4	5	0	6	A sentence on what adaptation and mitigation measures include would be informative and specific for SROCC in the ES. [Hans-Otto Poertner and WGII TSU, Germany]	Noted but, in the interest of keeping this summary statement short, we decided not to include further details (available in section 1.6)
29773	1	4	5	4	5	what is meant by trade-offs here. Please specify [Dorte Krause-Jensen, Denmark]	This was poorly worded. "Disbenefits" or "unintended consequences" was meant. This will be corrected in the next version.
26279	1	4	5	4	7	I imagine that the intention is to clarify that unilateral efforts by individual countries are insufficient to produce the desired global-scale solution. However, the sentence reads as a discouragement of local actions. I suggest a rephrasing of the sentence. [Zelina Ibrahim, Malaysia]	Accepted, the sentence has been revised accordingly.
27097	1	4	6	4	7	This sentence is a bit confusing. My understanding is that solutions at the local contribute to the solutions at the global scale. [XIAOMING WANG, Australia]	See reply above. This sentence has been clarified.
30593	1	4	7	0	8	Can you be more specific on adaptation measures and their limits? [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: text has been revised
11609	1	4	7	4	9	Indicate examples of unavoidable adaptation measures. [Government of Mexico, Mexico]	Noted: we don't assess specific examples in chapter 1. This is covered in chapters where relevant
15427	1	4	7	4	9	This sentence is not clear - how do you link limits to adaptation to unavoidable adaptation? Suggest rephrasing in "urgent efforts to minimise anthropogenic climate change are necessary to give adaptation measures the best chance of success" [EUCE, Belgium]	Taken into account: statement has been extensively revised. Words such as unavoidable and urgent are no longer used.
24641	1	4	7	4	9	need to update this line to be explicit to emissions (which is in the title of this paragraph on lines 1-2). Mititagation is both reduce emission and enhance sinks, but here we are just talking about reducing emissions (and not enhancing the sink). Suggest a change to: Limits to adaptation mean that urgent efforts to minimise anthropogenic carbon emissions are necessary to give unavoidable adaptation measures the best chance of success. This will then be consistent with the emissions statement within the mitigation definition that apperas on line 49-50 of page 23. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, sentence modified accordingly, using "grenhouse gases" rather than "carbon" as suggested.
26281	1	4	7	4	9	This is a confusing sentence and it is not really clear what is meant. I suggest a rephrasing as the word adaptation appears twice, once in relation to limits and the other to unavoidable. [Zelina Ibrahim, Malaysia]	Taken into account: This sentence has been revised.
26909	1	4	7	4	9	Not sure whether " Limits to adaptation mean that urgent efforts to minimize ...." or magnitude of the impacts and their irrerevesibility suggest urgency of action. At least, maginitude of impacts and irreversibility coulbd be bring here. [Golam Rasul, Nepal]	Taken into account: text was policy prescriptive and has been revised

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32807	1	4	7	4	9	"Limits to adaptation mean that urgent efforts to minimise anthropogenic climate change are necessary to give unavoidable adaptation measures the best chance of success." This sentence does not make sense. What are unavoidable adaptation mesaures? Is it the limits to adaptation or the impacts despite adaptation that make mitigation more urgent? [Government of United States of America, United States of America]	Accepted, see reply to comment above.
26811	1	4	11	0	18	The bolded statement states that the problem CAN be solved through international and trans-boundary cooperation. Is there evidence of this or is this opinion? Specifically, does the international and transboundary nature of the solution make the important difference? Examples that demonstrate this? Further, I'm not catching the message from this paragraph. On one hand we say that local solutions have fewer trade offs (previous paragraph). Here we lead with international/transboundary, but then talk about all levels of intervention. Too much jumbled into one paragraph to understand and not aligned to support the bolded sentence. Please revise. [Ko Barrett, United States of America]	Accepted: Text changed to bring in more clarity - text rephrased as "This report highlights the requirements for transformative governance, international and transboundary cooperation, and greater empowerment of local communities in the governance of the ocean, coasts, and cryosphere in a changing climate"
30595	1	4	11	0	18	A sentence on key challenges and the dimension of measures to be taken would be most useful. Later in the bullet local adaptation or adaptive and transformative governance is emphasized without providing specific information that at the same time would be illustrative. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - sentence revsied
32809	1	4	11	4	11	Suggest that the word "Some" be inserted before the word "Existing". Not all challenges can be addressed with transboundary cooperation and governence. [Government of United States of America, United States of America]	Accepted: wording changed to not be prescriptive
16449	1	4	13	4	18	text needs confidence statements [Georg Kaser, Austria]	Accepted: Confidence statement added
4953	1	4	14	4	15	"In addition to national to global-level governance and institutional options" sounds confusing. Consider rephrasing. [Debra Roberts and Durban Team, South Africa]	Accepted - text changed
26911	1	4	14	4	15	Not sure whether ' legal framework" is appropraite here. It connects mountain, floodplain, delta through hydrological and climate processs, that deserve mention here. [Golam Rasul, Nepal]	Accepted - Text changed - legal framework removed
24315	1	4	15	4	15	delete "-" between local and adaptation [Philippus Wester, Netherlands]	Accepted - Done thanks
26913	1	4	16	4	18	While the statement is correct, the Box 2 seems does not touch clearly on this. [Golam Rasul, Nepal]	Accepted: We give reference to CCB 2 where transformative adaptation is mentioned
27099	1	4	17	4	17	What does "context-relevant governance arrangements" mean? The whole paragraph seems not giving clear information or message. [XIAOMING WANG, Australia]	Taken into account: this text has been revised
26813	1	4	20	0	28	First this paragraph doesn't address governance at all. Please delete"governance and". Secondly, this is an important paragraph to establish the broad foundation for our knowledge of changes and response strategies. The story would be stronger if a sentence were added after the revised bolded sentence to briefly captured a sense of the diverse knowledge sources. Then go on with the rest of the paragraph. [Ko Barrett, United States of America]	Rejected and Accepted: In terms of your first comment, we have not removed governance because it is highly relevant to the inclusion of the diversity of knowledge systems. In terms of your second comment, we have revised accordingly by laying out the knowledge systems.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
30597	1	4	20	0	28	The point on scientific knowledge needs specific information as this could be said about any scientific discipline or region. Similarly the sentence on indigenous knowledge requires specifying where in ocean and cryosphere and how it plays out. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: the wording around knowledge gaps has been made more specific. Text on advances in scientific knoweldge since AR5 has been moved to a different paragraph. Indigenous and local knowledge now text in ES is now framed around response options.
30573	1	4	20	1	37	I would suggest to merge these two paragraphs and describe as specifically as possible which gaps need to be closed and how this could be done. Ending this first Executive Summary of the SROCC with a paragraph that addresses uncertainty shifts the focus away from what science knows and adds a questionmark to the outcomes of the assessment. [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: we have not merged these paragraphs as they are covering different messages, but we have revised them extensively to make the messages clearer.
4955	1	4	20	4	28	Confidence statement required. [Debra Roberts and Durban Team, South Africa]	Accepted: text revised
26915	1	4	21	4	23	better to drop 'in pooly sampled or unsampled areas' from the sentence [Golam Rasul, Nepal]	Taken into account, the sentence is no longer in the text.
30449	1	4	22	4	22	Continued development of scientific knowledge as well the use of latest Big Data and Machine Learning solutions are crucial [Michele Capobianco, Italy]	Taken into account: we don't mention this specifically, but have revised the text and use this to support the paragraph on pervasive ocean and cryosphere changes.
17263	1	4	25	4	27	In this paragraph about knowledge sources, the reference to Indigenous knowledge should be seperated and put into it's own paragraph immediately below. Local knowledge can certainly stay here but considering that the cryosphere is a focus of this special report, and that the majority of the population living in the Arctic is Indigenous, particular attention and emphasis must be put on Arctic Indigenous knowledge by creating a unique paragraph. Furthermore, Indigenous knowledge and local knowledge are very distinct from one another but this is not made clear by lumping them together here. Suggested text could be along the lines of the following: Indigenous Knowledge, particularly knowledge of Arctic Indigenous Peoples, is essential in understanding and responding to the rapid changes impacting the cryosphere, specifically the poles. For individuals, communities, and institutions to effectively adapt, recover, or adjust to change, respect for and recognition of Indigenous knowledge and the innovation and quick adaptive decision making demonstrated by Indigenous Peoples since time immemorial is crucial. Adaptation measures would be greatly enhanced by affording Arctic Indigenous Peoples the political and intellectual space to determine and define what they believe to be vulnerabilities and to determine their collective measures for addressing them. [Joanna MacDonald, Canada]	Rejected: This is important but we cannot address this depth of understanding in the ES but we repsresent it in the CCB 3 and in Ch 3
30599	1	4	30	0		Adaptation planning needs specific key examples and associated limits [Hans-Otto Poertner and WGII TSU, Germany]	See response to #30601

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
30601	1	4	30	0	37	Adaptation planning needs specific key examples and associated limits. Consideration of adaptation limits should also be included in this generalized statement. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: examples of adaptation planning are not the focus of this paragraph, but we have given examples of the types of approaches that can be used to inform adaptation planning where uncertainty in ocean and cryosphere changes exists.
26917	1	4	30	4	31	Not sure whether " comprehensive risk assessments .... can address future ocean and cryosphere change" . Risk assesssmnet is just one of the action of many other action necessary to address future ocean and cryosphere change.. [Golam Rasul, Nepal]	Noted: unclear what is being suggested without specific examples. We have revised the paragraph extensively and given examples of approaches to information risk assessments where uncertainty exists.
29589	1	4	31	4	31	"Certainty" does not evolve, one is certain or not. What can evolve and has levels is "confidence", which is why the IPCC lexicon has levels of confidence. The word "Certainty" here needs to be changed to "Confidence"--and any uses elsewhere that imply "certainty" can change in meaning need to be similarly changed. [Michael MacCracken, United States of America]	Taken into account: wording of paragraph revised extensively
27101	1	4	31	4	33	The availability of data and knowledge of physical and ecological processes does NOT implies the assurance of certainty. Uncertainty always naturally co-exists with any physical and non-physical processes, with some that may be reduced by the improvement in knowledge, and some that can NOT be reduced. It called epistemic and aleatoric uncertainty, respectively. [XIAOMING WANG, Australia]	Taken into account: wording of paragraph revised extensively
23593	1	4	31	4	41	Suggest adding relevant findings on ice sheets (Greenland, Antarctica). [Government of Sweden, Sweden]	Taken into account: this text is no longer in the revised ES
16259	1	4	33	4	34	While crucial new knowledge has been generated on Antactic ice sheet dynamics and implications for sea level rise since AR5, it is wrong to say that this improved process understanding has reduced uncertainties in sea level projections. To our knowledge, the unresolved issues of how exactly ice shelf/sheets will respond to ongoing Antarctic warming, has further widened the uncertainty range. In SROCC, this topic is framed under deep uncertainties. Please revise and clarify! [Alexander Nauels, Germany]	Taken into account: wording of paragraph revised extensively
28541	1	4	33	4	34	The sentence should be well expantiated to include the new knowledge mentioned [Andrew Eloka-Eboka, South Africa]	Taken into account: this text is no longer in the ES
23609	1	4	33	4	37	This leaves it very unclear, how much knowledge there is and on what aspects. Presently, it reads that uncertainties have been reduced on two aspects (reduced uncertainty does not, however, inform how uncertain they are), whereas other aspects are deeply uncertain. The latter probably applies to a subset of aspects, such as long-term sea level rise. This section should be nuanced better to provide information on robustness and uncertainties. Or, just state the more certain and the main deeply uncertain ones in more detail, as appropriate. [Government of Sweden, Sweden]	Taken into account: wording of paragraph revised extensively
5233	1	4	34	4	35	I propose add: "However, other aspects of the rate, timing, magnitude, biodiversity lost, and cascading elements of ocean and cryosphere change remain....." [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account: wording of paragraph revised extensively

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29591	1	4	34	4	37	This seems to me too strong a statement about uncertainties about what lies ahead. I would strongly suggest adding a box to the chapter that provides some context from paleoclimatic and paleooceanographic understanding (I just do not think that section 1.8.1.2 is adequate). The key insight from such studies is that, for example, sea level has changed by large amounts in the past as a result of (and in part as a driver of) very large changes in sea level--that at the Last Glacial Maximum, sea level was down 120 meters with the reconstructed decrease in global average temperature (GAT) being down about 6 C is a particularly strong attention grabber with the public and decisionmaker-level people that I talk with. For many members of the public, they think of Greenland, for example, as huge block of ice and when I ask them to name a country about the size of Greenland, they are astounded (because classroom maps are typically Mercator projections) that Australia and Brazil are 4X the size of Greenland, that India is 1.5X Greenland and that plausible answers to my question are Libya, Saudi Arabia, or Mexico; and that Antarctica holds of order 10X as much as Greenland. As examples of what has been learned from such studies that is relevant to what lies ahead, I'd suggest that the box present information about the LGM having SL 120 m below present with GAT down roughly 6 C, that the Eemian had SL something like 4-8 m higher when GAT was perhaps up 1 C (and this with the CO2 concentration less than 300 ppm), and that a few tens of millions years ago, there was no Greenland ice sheet and virtually no Antarctic ice sheet when GAT was up perhaps 4 C and SL must have been up 60-70 m or so. At equilibrium, it appears that the equilibrium sea level sensitivity is something like 15-20 meters per degree C. As to how long it would take to get to equilibrium, model simulations not counting ice stream movement (so just thermal energy exchange) is perhaps a few thousand years for Greenland, for example, but it is really striking that from 20 ka to 8 ka, average sea level rose 1 m/century for 120 centuries while the GAT was rising 1 C/2000 years and the CO2 concentration stayed below 300 ppm (and with this low CO2 concentration, the ice sheets could have radiated away in winter a lot more IR than they can today with the CO2 concentration at 400 ppm and rising. We are in a situation with the GAT rising at a rate of something like 1 C every 50 years and a rising CO2 concentration--it really seems implausible that the rate of SL rise will be only a meter per century and not implausible the rate of SL rise could be much higher. I also think it would be important to give greater attention to how long the loss of mass of ice sheets could go on, pointing out that paleoclimatic records make clear that ice sheets deteriorate much more rapidly than they build up, so the likely future of the temperature overshoot heading up to well over 2, or 2.5 or even 3 C, the potential equilibrium sea level rise is very	Taken into account: It was discussed amongst the author team whether to include a box on palaeoclimate data. It was decided that it is better to use palaeoclimate data to give context to observed and projected changes where relevant in the assessment. This has been done within the chapters for the FGD.
26919	1	4	35	4	37	This sentence need more clarity. Please note that effective planning is necessary but not sufficient. [Golam Rasul, Nepal]	Taken into account: wording of paragraph revised extensively
4957	1	4	36	4	36	Italicise confidence and likelihood statements. [Debra Roberts and Durban Team, South Africa]	Accepted
22989	1	4	36	4	36	"Catastrophic consequences" : not usual IPCC language. Which ones, where, for whom? This needs more rigor. [Valerie Masson-Delmotte, France]	Taken into account: wording of paragraph revised extensively. This wording is no longer used.
27105	1	4	36	4	36	Confidence and likelihood are two different concept in statistics. Please apply more specifically. [XIAOMING WANG, Australia]	Noted: The paragraph has been revised and this wording is no longer used.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27103	1	4	36	4	37	The statement could cause misunderstanding that adaptation have to be implemented to avoid catastrophic consequence even if it has a very low likelihood. The responses to rare event is based on risk not consequences or likelihood alone. Meanwhile, the whole paragraph didn't give the clarification of what is the "comprehensive risk assessment", which seems just risk assessment. [XIAOMING WANG, Australia]	Taken into account: wording of paragraph revised extensively
29775	1	4	37	4	37	please add "especially" before "if…", since changes could potentially have catastrophic consequences even if realised without effective adaptation planning… [Dorte Krause-Jensen, Denmark]	Taken into account: wording of paragraph revised extensively
29029	1	4	44	4	44	Add at least a sentence here on different outcomes at different emissions scenarios further out, for example: "…by 2100, even at low emissions scenarios. However, beyond 2100 to 2300, some remants in certain mid-latitude glacier systems are projected to remain under low emissions (RCP2.6), but will be lost under high emissions pathways (RCP8.5) (confidence level). Some low latitude (tropical) glaciers are not expected to remain even under low emissions scenarios." [Pam Pearson, Sweden]	Rejected: this is part of the assessment of other chapters, rather than the framing.
11627	1	5	1	5	1	Change "all people depend either directly or indirectly" to "all people depend directly and indirectly" [Government of Mexico, Mexico]	Accepted: this change has been made
18341	1	5	3	5	5	It is better if we can mention the level of risk for this paragraphs. [APECS Group Review, Germany]	Accepted: this change has been made
28543	1	5	3	5	5	Is it possible to include some of the human induced climate change activities contemplated? [Andrew Eloka-Eboka, South Africa]	Noted: human examples are detailed in many places in subsequent paragraphs of section 1.1
30477	1	5	4	5	5	This sentence is very close to being policy prescriptive. Consider revising. [Hans-Otto Poertner and WGII TSU, Germany]	Noted: sentance has been re-written, and we don't believe that the wording is prescriptive.
18353	1	5	5	5	5	Again, the level of risk would make this statement more effective. [APECS Group Review, Germany]	Accepted: this change has been made
27109	1	7	5	7	5	It would be good to have a consistent definition of the cryopshere. [XIAOMING WANG, Australia]	Accepted: a definition for cryosphere has been added to the glossary and this is introduced in the SPM and in box 1.1
28261	1	5	5	5	5	…putting sustainable development pathways at high risk. [Benedikt Ehrenfels, Switzerland]	Noted: wording of the sentence has been added, and a confidence assignment given.
27107	1	7	5	7	6	The cryosphere may include more elements than what are listed here. [XIAOMING WANG, Australia]	Accepted: a definition for cryosphere has been added to the glossary and this is introduced in the SPM and in box 1.1
23589	1	5	6	5	7	"This exemplifies the limits to the ability of existing natural resource management frameworks to address ecosystem change." could be redrafted into a statement in itself, for example, "In general, the ability of existing natural resources management frameworks to address ecosystem change has limits.", if appropriate. Cf. Lines 15-16. [Government of Sweden, Sweden]	Noted: the section has been extensively revised and this comment does not fit well with the revised text. The text in section 1.7 and CCB3 gives further detail of the limitations of current governance frameworks.
26815	1	5	7	0	29	This paragraph is a jumble of ideas - all good - but hard to digest because they come at the reader without a clear storyline. Why mention hazards for Arctic and high mountain people if we don't ever discuss any? Please consider a new paragraph starting after the Sharma et al reference. Another paragraph break would be useful after the FAO reference. [Ko Barrett, United States of America]	Accepted: throughout section 1.1 the paragraphs have been shortened to help readers following the flow of ideas.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14887	1	5	7	5	18	Would it be possible to include a general/global estimate of the number of people dependent on the freshwater resources and other services that originate from high mountain regions? The case of the Himalaya is intriguing, a global figure would add value. [Government of Germany, Germany]	Accepted - Text revised for Himalayas - Global figure is not available
18127	1	5	8	5	11	E2: According to Kummu et al., 2016 the population in near-coast zone in 2010 was 28% (Table 2 in Kummu et al., 2016) [APECS Group Review, Germany]	Accepted: This has been updated (the 27% figure previously used is also used in the Kummu reference and is derived by summing the relevant components in Figure 2, so we assume the difference is related to rounding errors).
14889	1	5	8	5	13	It is not clear why the authors chose 100 km distance from the shore and 100 m elevation as qualification for "coastal zone" - is this a standard definition? The reference to less than 10 m elevation above SL seems intuitive as a threshold for vulnerability to extremely high sea level events, erosion and other climate change impacts, but the numbers above are not self-explanatory. Please clarify or revise. [Government of Germany, Germany]	Accepted: We have revised this section to refer more closely to the low elevation coastal zone.
2825	1	5	8	5	8	Please give a clear definition of “coast” [Baoshu Yin, China]	Accepted: We have revised this section to refer more closely to the low elevation coastal zone.
5163	1	5	10	0		SR1.5 Chap 3 used a different definition of megacity (a population greater than 1 million in 2005). Is it possible to be consistent with SR1.5 to assist policy makers to make comparisons across the reports - different figures tend to create doubt? [Debra Roberts and Durban Team, South Africa]	Accepted: we have removed the term "megacity" and replaced with the term "major city" that is used in the cited reference for cities with a population greater than 5 million.
26817	1	5	10	0		UN DESA defines megacities as cities of more than 10 million people and identifies 31. Please check sources [Ko Barrett, United States of America]	Accepted: we have removed the term "megacity" and replaced with the term "major city" that is used in the cited reference for cities with a population greater than 5 million.
18129	1	5	12	5	13	E2: The reference Jones and O'Neill (2016) does not project population for 2050 but for 2100 [APECS Group Review, Germany]	Accepted: We have changed the reference here to ONeill et al 2017, describing what the SSPs are.
17265	1	5	13	5	14	It would be helpful after the sentence "Approximately 4 million people live in the Arctic.." to note that this include over 160,000 Inuit. I'm not sure what the stats are for other Arctic Indigenous Peoples but this is important contextual information to have. [Joanna MacDonald, Canada]	Noted: This comment has been passed to chapter 3. In chapter 1 overview we don't feel that we should be specific on numbers that are relevant specifically to chapter 3 rather than the whole report.
28545	1	5	14	0	14	Instead of Chapter two as citation, can there specific reference/citation? [Andrew Eloka-Eboka, South Africa]	Noted: There isn't a specific reference for this, but citation is given to the section in chapter 2 that now describes the calculation of this population number.
4959	1	5	14	5	14	Rather refer to section of the chapter instead of the entire chapter. [Debra Roberts and Durban Team, South Africa]	Accepted.
16647	1	5	14	5	14	"890 million" : where is this number coming from ? I see it nowhere in Chapter 2. [Samuel Morin, France]	Accepted: we have worked with chapter 2 to develop these numbers and have them in both chapters
30481	1	5	14	5	14	As you do not refer to any other chapter in this entire paragraph, I suggest remove the reference to Chapter 2, here, and provide the original (journal) reference instead. [Hans-Otto Poertner and WGII TSU, Germany]	Noted: we now refer to the relevant sections of chapters 2,3 and 4 for population numbers and have worked with those chapters to check on consistency.
30305	1	5	15	5	15	The pronoun "these" is ambiguous unless it is immediately followed by it antecedent. Are the authors referring to "these resources"? [Paul Glaser, United States of America]	Accepted: we have specified that this is refering to "these systems" [ocean and cryosphere]
24317	1	5	17	5	17	replace "distributes" with "provides" in the Hindu Kush Himalaya …. [Philippus Wester, Netherlands]	Accepted: changes made.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24319	1	5	17	5	18	The figure should be 1.65 billion people living in downstream basins, not 1.9 billion. Also note Sharma et al. has now been published. [Philippus Wester, Netherlands]	Accepted - Text revised
16649	1	5	18	5	18	"1.9 billion people" : where is this number coming from ? Is IPCC uncritically accepting this number ? The original reference states that "Nearly 1.9 billion people living in the 10 river basins also benefit directly and indirectly from its resources (see Box 1.1)". This does not mean that "The HKH distributes freshwater for more than 1.9 billion people". First, it is not "more" but "nearly", and also there are other sources of fershwater. The original publication is more balanced than the text here. [Samuel Morin, France]	Accepted: wording of text in this section has been revised in discussion with chapter 2, and additional references and examples are used. The 1.9 billion number is no longer reported.
17481	1	5	18	5	20	Mention that the Arctic sea ice works as a protective, reflective shield, and its steady decline is accelerating the warming experienced on Earth, impacting populations around the world. [Kristin Campbell, United States of America]	Duplicate comment. See response to #17581
17581	1	5	18	5	20	Mention that the Arctic sea ice works as a protective, reflective shield, and its steady decline is accelerating the warming experienced on Earth, impacting populations around the world. The changes in the Arctic have a strong impact outside of the Arctic, through teleconnections and changes to the jet stream as well as impacts on the AMOC. [Durwood Zaelke, United States of America]	Noted: This topic is assessed in chapter 3. Detailed discussion of all of the linkages of sea ice can't be accommodated in the space constraints of section 1.1
8701	1	5	19	0		"the ocean is the primary source of rainfall needed to sustain life on land" - this sentence doesn't make sense as it stands. Is this through precipitation? I think clarification needs to be given to make it more clear. [Nina Hunter, South Africa]	Accepted: edit made
16651	1	5	19	5	19	Why focus on "rainfall" ? This excludes "snowfall", the total being "precipitation". "Snowfall" also contributes to sustaining life on land, it would be good to recognize this in a "cryosphere" report. [Samuel Morin, France]	Accepted: edit made
24321	1	5	20	5	20	start new paragraph after the word land. Now paragraph from lines 7 to 29 is too long. [Philippus Wester, Netherlands]	Accepted: paragraphs in section 1.1 have been split so that they are shorter.
23591	1	5	20	5	22	Would it be possible to complement with the case of strong mitigation scenarios? [Government of Sweden, Sweden]	Accepted: We have added information later in section 1.1 on economic value/costs that contrasts different future scenarios.
23595	1	7	25	7	25	"the shift to predominantly seasonal ice cover" is not clear. There are seasonal differences in the sea ice cover already without climate change, and ice free seasons are (possibly) some time into the future. Please redraft for clarity. [Government of Sweden, Sweden]	Accepted: This has been added to section 1.4.2
8703	1	5	26	0		the' missing before 'achievement' [Nina Hunter, South Africa]	Accepted: text corrected
16451	1	5	31	5	57	several of the statements need to be rearranged in view of the SR1.5; e.g. coral reef decline [Georg Kaser, Austria]	Noted: the statements on ecosystem risks have been removed in revising section 1.1. These will be covered in the assessments of the individual chapters.
18153	1	5	31	5	57	This paragraph is exceptionally long; I think the longest in Ch 1. A potential paragraph break lies at "Once initiated" on line 45. [APECS Group Review, Germany]	Accepted: paragraphs in section 1.1 have been split so that they are shorter.
27111	1	7	32	7	32	Wold it be better to use solar radiation instead of solar energy? [XIAOMING WANG, Australia]	Not applicable anymore: The figure has considerably changed, and now focuses on ocean and cryosphere characteristics only.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
26819	1	5	34	0	38	This needs to be said carefully. The temperature targets of the Paris agreement are targets of collective threshholds of acceptable risk. Scientific evidence did not drive the policy community to these targets. In many areas we still don't know whether 1.8 degrees or 2.4 degrees tips a threshhold. We really don't. So at best we can say science can provide evidence for the risks likely at these levels, but the levels were not science driven, they were policy driven. [Ko Barrett, United States of America]	Accepted: reworded according to reviewer comments
32811	1	5	34	5	37	"Commit" is a term of art in international law, and the Paris Agreement Article 2.1 uses the word "aim." Subsequently, Parties to the Paris Agreement aimed to strengthen the global response to the threat of climate change, including by holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. [Government of United States of America, United States of America]	Accepted: reworded according to reviewer comments
22991	1	5	35	5	35	Please reformulate the Paris Agreement avoiding "committed governments to". Be factual (the main goal is…). [Valerie Masson-Delmotte, France]	Accepted: reworded according to reviewer comments
27113	1	7	37	7	37	It may not accurate to call it "permanently frozen ground", as it may melt as well. [XIAOMING WANG, Australia]	Noted: a glossary term for cryosphere has been added to the report, and is used consistently in box 1.1
8705	1	5	39	0		Another bracket is needed after 'likely'. [Nina Hunter, South Africa]	Noted: the other side of the brack comes after the reference to SR1.5 Allen et al)
4309	1	5	39	5	39	Instead of using the IPCC SR1.5 reference, I would suggest to use the original references of the peer-reviewed literature. [The UBern Team Group Review, Switzerland]	Rejected: this refers specifically to the assessment of the current level of warming made in the SR1.5 report.
4961	1	5	39	5	39	The SR1.5 states that commitments more ambitious that those currently made under the Paris Agreement are required to stave of dangerous global warming. [Debra Roberts and Durban Team, South Africa]	Noted: we have removed this reference to "dangerous" in the revisions to section 1.1, so this clarification doesn't appear to be needed any more in this section.
22429	1	5	39	5	39	Suggest ensuring consistency between the SROCC and SR1.5C. The SR1.5C report (SPM A1.1) states: observed GMST for the decade 2006–2015 was 0.87°C (likely between 0.75°C and 0.99°C). [Government of Australia, Australia]	Noted: We are citing the statement made in SR1.5 SPM A1 "Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C."
24323	1	5	39	5	39	instead of likley use a confidence statement. I suggest high agreement, robust evidence [Philippus Wester, Netherlands]	Noted: likelihood statement is from the SR1.5 assessment. This section has been removed in revisions to 1.1
11807	1	5	40	5	42	Add that 25% of marine species spend some part of their life cycle in coral reefs and are thus dependent on them. [William Lorenz, Australia]	Noted: This section of text was removed in revising section 1.1
13721	1	5	40	5	42	Text notes 'there is a risk of irreversible loss of many marine and coastal ecosystems with warming of 2degrees or more', a brief couple of examples here would be helpful. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted: This section of text was removed in revising section 1.1
3141	1	5	42	5	44	The previous two statements related to coral reefs and coastal ecosystems have assigned confidence levels. What is the level of confidence for the expected changes in the Arctic and mountain systems? [Sloane Garelick, United States of America]	Noted: This section of text was removed in revising section 1.1

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16653	1	5	42	5	44	I'm unconfortable with these statements in this section 1.1. This should be the product of the assessment, not the framing. Further, "mountain systems" are little addressed in SR15, given that much of the mountain content is referred to be addressed in SROCC. I see some risk of circularity here. [Samuel Morin, France]	Noted: This section of text was removed in revising section 1.1
17267	1	5	42	5	44	The sentence "Arctic and mountain systems are also expected to be at high risk of dangerous climate change impacts as global temperatures approach or exceed 1.5°C to 2°C above pre-industrial…" fails to communicate that Arctic systems have already experiences dangerous climate change impacts and rates of warming 2-3 times faster than the rest of the world. It is essential to communicate that the Arctic has already experienced irreversible environmental changes due to climate change and that this is not something in the future. It is happening now and has been occuring over the last decade at an increasingly alarming rate. [Joanna MacDonald, Canada]	Noted: This section of text was removed in revising section 1.1
17483	1	5	42	5	45	Arctic warming at twice the global rate; also home to multiple feedbacks processes and tipping points. See 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; and Steffen W., et al. (2018) Trajectories of the Earth System in the Anthropocene, PROC. NAT'L. ACAD. SCI. 115(33):8252–8259. [Kristin Campbell, United States of America]	Duplicate comment. See response to #17483
17583	1	5	42	5	45	Arctic warming at twice the global rate; also home to multiple feedbacks processes and tipping points. See 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; and Steffen W., et al. (2018) Trajectories of the Earth System in the Anthropocene, PROC. NAT'L. ACAD. SCI. 115(33):8252–8259; Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Durwood Zaelke, United States of America]	Noted: This section of text was removed in revising section 1.1
30485	1	5	43	5	43	Rephrase "dangerous" climate change impacts [Hans-Otto Poertner and WGII TSU, Germany]	Noted: This section of text was removed in revising section 1.1
24325	1	5	45	5	45	start new paragraph after press-a). [Philippus Wester, Netherlands]	Accepted: paragraphs in section 1.1 have been split so that they are shorter.
17485	1	5	45	5	53	The non-linear aspect of these changes is increased with increased forcing, leading to even further uncertainty; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142; and Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sciences 114(39):10315–10323. [Kristin Campbell, United States of America]	Duplicate comment. see response to #17585

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17585	1	5	45	5	53	The non-linear aspect of these changes is increased with increased forcing, leading to even further uncertainty; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142, 140–141 (“Nonlinearity has implications not just for the ensemble mean, but also for the spread of model projections. In general, an increased spread at higher forcing should be expected: the relative importance of nonlinear mechanisms grows with increasing forcing, so their contribution to model spread does likewise. Conceptually, this can be thought of as including an extra uncertain process at higher CO2 concentrations. This inflation in model spread at higher forcing is large when nonlinearities are uncertain, and seems to be especially relevant for change per kelvin of global warming.”); At the same time, uncertainty with the climate sensitivity and how these feedbacks will impact the climate system leads to consideration of the “fat tail” risk that can extend into the catastrophic range of warming; see Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sciences, and Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Durwood Zaelke, United States of America]	Noted: This aspect can't be covered in detail in section 1.1, but may be relevant to the concepts described in section 1.3
25879	1	5	46	3	46	losses of .. Ice sheets' should be rephrased (not consistent with 'relevant to human socities'). How about: "decline of ice sheets, glaciers and permafrost" or: "ice sheet and glacier mass loss and permafrost degradation". [Regine Hock, United States of America]	Accepted: we have rephrased according to this suggestion.
25883	1	5	46	3	46	Is 'dangerous limate change' the best term here ? Dangerous for what and who? Schneider 2001, What is 'dangerous' climate change, Nature, puts dangerous in quotation marks. [Regine Hock, United States of America]	Noted: This section of text was removed in revising section 1.1
32813	1	5	47	5	47	"may be irreversible" seems overly conservative, since all of the processes mentioned are "likely irreversible". [Government of United States of America, United States of America]	Accepted: wording revised as suggested
4311	1	5	47	5	48	Maybe add here Frölicher et al. (2010): Reversible and irreversible impacts of greenhouse gas emissions in multi-century projections with the NCAR global coupled carbon cycle-climate model. Climate Dyn. 35, 7-8, 1439-1459. [The UBern Team Group Review, Switzerland]	Accepted: this citation has been added
13719	1	5	48	5	49	"Furthermore, changes in the ocean…". This is an important message that should be included in the SPM. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted: the SPM has undergone extensive development to bring out clear and important messages

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
646	1	5	48	5	50	This sentence seems to imply the positive feedbacks associated with ocean and cryosphere alone. I think it is better to rephrase it so that the readers can know there are also negative feedbacks, e.g., the ocean carbon uptake with a higher pCO2. [Mengxi Wu, United States of America]	Noted: Details on this are provided in section 1.2 and earlier in section 1.1
4313	1	5	48	5	50	Maybe add here also the the ocean's uptake capacity of anthropogenic carbon decreases with increasing CO2 levels. [The UBern Team Group Review, Switzerland]	Noted: we mentioned uptake of CO2 in section 1.1, but leave future uptake potential to other chapters to assess.
32815	1	5	50	5	50	This sentence is about feedback to the climate system. It's not just the absorption of solar energy through ice loss that is important, it's the consequent warming of air temperatures at a rate two to three times greater than the rest of the planet and the loss of sea ice in the Arctic. [Government of United States of America, United States of America]	Accepted: Arctic amplification has been added to the sentence.
17227	1	5	51	5	57	"The irreversible and amplifying nature. . ." This seems like a sentence that is really a take-home point, and it should be highlighted. However, it feels a bit buried in the middle of this paragraph, particularly because the sentence following it, (the final sentence of the paragraph), seems very dense. I suggest some rewording to the final sentence here to make it shorter/easier to read, and/or some rearrangements to the text in this paragraph as a whole. [Andra Garner, United States of America]	Noted: the structure of 1.1 and this paragraph has been changed, but we have retained this message at the end of a paragraph as a key message.
17269	1	5	55	5	55	It is important in this sentence to include the relationship that Indigenous Peoples have with the ice environment and as such suggested addition in caps: "...maintain centuries to millennia-old relationships to the planet's polar, mountain, and coastal, AND CRYOSPHERE environments..." [Joanna MacDonald, Canada]	Noted: we haven't made this suggestion as the cryosphere is part of the polar and mountain environments.
26821	1	6	2	0	5	While true, more importantly, this report was commissioned by almost 200 hundred IPCC member countries recognizing the importance of these issues [Ko Barrett, United States of America]	Accepted: wording revised accordingly
21639	1	6	2	6	14	In this sentences, SROCC is described as a new knowledge since AR5, and the association with SR1.5 and SRCCL is described. However, there is no mention of the association of SROCC with AR6. It is expected that the approval of SROCC will need to be added to the description of AR6 in the field of ocean and cryosphere issues. [Government of Republic of Korea, Republic of Korea]	Noted: we agree that it will be appropriate for AR6 to include reference to SROCC when they assess areas related to the ocean and cryosphere.
22613	1	6	2	6	14	in this sentences, SROCC is described as a new knowledge since AR5, and the association with SR1.5 and SRCCL is described. However, there is no mention of the association of SROCC with AR6. It is expected that the approval of SROCC will need to be added to the description of AR6 in the field of ocean and cryosphere issues. [IN-SEONG HAN, Republic of Korea]	Duplicate comment: see reponse to #21639
16453	1	6	5	6	5	AR5 (2013-2014): numbers are confusing, just write AR5 [Georg Kaser, Austria]	Accepted: change made
30525	1	6	6	6	6	Two WGs – I and II only for SROCC [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: text corrected.
24327	1	6	7	6	7	replace "represents" with "is" [Philippus Wester, Netherlands]	Accepted: change made
32817	1	6	8	6	11	Use of the word "urgency" is not policy-neutral. Suggest rephrasing the sentence to read "The recent IPCC Special Report on Global Warming of 1.5°C (SR1.5) concludES that human-induced warming will reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate." [Government of United States of America, United States of America]	Accepted: sentence has been rephrased according to wording in the SR1.5 SPM.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
30487	1	6	8	6	8	I suggest saying "...(in addition to the three working groups' main assessment reports)." [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: change made
26823	1	6	9	0		Suggest deletion of "the urgency of the Paris Agreement targets" because 1) it would be best to focus on the scientific outcomes of the report as you do in the rest of the sentence and 2) if anything, the report highlights how inadequate the Paris targets are, a point best not made in this report. [Ko Barrett, United States of America]	Accepted: this statement has been removed.
4353	1	6	9	6	9	Reference to SR15 report should include the exact chapter. [The UBern Team Group Review, Switzerland]	Noted: The reference is specifically to the SPM of SR1.5
30489	1	6	12	6	12	The approval plenary for the SRCCL will be in August 2019, not in October. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: correction made
11363	1	6	16	6	16	There is no ocean in high mountains, so you cannot assess ocean changes in high mountains. [Anson Cheung, United States of America]	Accepted: we've replaced "and" with "and/or"
648	1	6	16	6	19	It is not clear from this paragraph where (in which chapter) the readers can find detailed information about changes in the basic physical properties of global oceans (temperature, salinity, surface fluxes, circulation, etc.). [Mengxi Wu, United States of America]	Noted: this section of text has been removed in the revision of section 1.1
30483	1	6	16	6	19	Also refer to integrative CCB7 LLIC here. [Hans-Otto Poertner and WGII TSU, Germany]	Noted: this section of text has been removed in the revision of section 1.1
26921	1	6	16	6	25	this para and sub-section 1.10 (page 50 line 28 to 57) tell almost same things. This para and sub-section 1.10 can be integrate to save space. [Golam Rasul, Nepal]	Noted: we have removed this section from 1.1, and kept the storyline at 1.10 to provide a conclusion to the chapter and a segway to the subsequent chapters
30527	1	6	16	6	25	Two new cross chapter boxes 5 and 6 to be included here [Hans-Otto Poertner and WGII TSU, Germany]	Noted: this section of text has been removed in the revision of section 1.1
17271	1	6	23	6	23	In the roadmap of Ch.1 here, the very broad term 'knowledge systems' is used in reference to cross-chapter box 3. The focus on INDIGENOUS knowledge specifically is the central focus to this cross-chapter box. From what I understand, there is also interest from IPCC to be considering how to engage with Indigenous knowledge, a process in which this corss-chapter box is the first step. As such, in the roadmap, this spcific focus should be highlighted rather than simply 'knowledge systems'. Indigenous knowledge is much more than a knowledge system. Indigenous knowledge is a systematic way of thinking applied to phenomena across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. Under this definition, IK goes beyond observations and ecological knowledge, offering a unique 'way of knowing' to identify and apply to research needs which will ultimately inform decision makers. [Joanna MacDonald, Canada]	Noted: this detail can't be accommodated in the space constraints of section 1.1, but will be considered in 1.8.2 and the cross chapter box in IK and LK.

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30491	1	6	28	8	11	This Box is very useful and provides a good overview. [Hans-Otto Poertner and WGII TSU, Germany]	Thank you
32819	1	6	30	7	11	Excellent text box describing the oceans and cryosphere and their components. [Government of United States of America, United States of America]	Thank you
22993	1	6	32	7	42	Missing information on characteristic time scales, frozen lakes and rivers. The box is too qualitative and does not enough convey an idea of what is new since AR5. [Valerie Masson-Delmotte, France]	Agreed. Frozen lakes and rivers have now been mentioned in the definiton of the cryosphere, but not elaborated on any futher as they are not discussed in the following chapters.
17229	1	6	35	6	36	". . . And provides roughly half of the primary production on Earth." It is not completely clear to me what this means. Perhaps some additional clarification is needed? [Andra Garner, United States of America]	Rejected. We think it is clear that the ocean provides about half of the primary production trough the process of photosynthesis
8707	1	6	36	0		Primary production' may be unclear to the reader. It would be useful to have a brief definition in parentheses. [Nina Hunter, South Africa]	Rejected: This means that ocean have of the same primary production then land.
32821	1	6	42	6	43	Ocean depth and distance do not determine ocean governance. People detemine ocean governance. Ocean depth and distance to the coast may "influence" ocean governance. [Government of United States of America, United States of America]	Agreed: the verb "may" has been added
4845	1	6	46	0		"determined" - what is determined? The thickness or distribution of the layers? [Debra Roberts and Durban Team, South Africa]	Agreed: The sea water temperature determines the stratification of the layers. We modified the text to make it clearer.
4355	1	6	46	6	46	maybe replace 'normally' with vertically [The UBern Team Group Review, Switzerland]	Agreed
8709	1	6	48	0		Water column' may be unclear to the reader. It would be useful to have a brief definition in parentheses. [Nina Hunter, South Africa]	Rejected: A water column is a common term for a conceptual column of water
650	1	6	55	6	56	Seawater has a specific heat four times larger than air, but the ocean mixed layer has an even greater heat capacity because it holds more mass than the atmosphere. [Mengxi Wu, United States of America]	Thank you, but due to space limitation this specification could not be considered.
11365	1	6	56	6	56	Inconsistent language use. The term heat is used here, but it is referred as energy in Box 1.1, Figure 1 and Section 1.2.1 [Anson Cheung, United States of America]	"Thank you, and the comment is taken into account. In Figure 1, 'energy' is changed to 'heat'."
18173	1	6	56	6	57	Ocean-atmosphere momentum flux should be included here. [APECS Group Review, Germany]	Thank you. Fig. 1 is a shematic overview on ocean and cryosphere characteristics, and is thus not aiming to deliver specific details on all fluxes - the shemtic inidcation of the energy cycle includes all air-sea-flux exchanges, as indicated by using the therminology 'heat cycle' in the figure caption.
4847	1	6	57	0		Is CO2 as easily absorbed from the air as returned back into the air if the concentrations are changed i.e. if we reduce emissions low enough, will CO2 escape from the ocean as easily as it has been absorbed (at least the CO2 at the surface)? This pint should be made clear somewhere in the text. [Debra Roberts and Durban Team, South Africa]	Rejected - because: Before the Industrial Revolution the CO2 exchange rate between the ocean and the atmosphere were pretty well balanced, but ever since we began emitting CO2the ocean has been trying to catch-up with the atmosphere. If and when our CO2 emissions ever level off it will take the atmosphere and oceans several centuries to reach equilibrium. A good reference is: https://www.maritime-executive.com/features/ocean-storage-of-co2
30603	1	6	57	0		Wouldnt this list need to include oxygen? [Hans-Otto Poertner and WGII TSU, Germany]	Thank you, oxygen is added to this list now.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18131	1	7	0	7	0	E1a: There is an unbalance in the Criosphere components relationship with climate. The text only presents the relationship of sea ice with the climate. [APECS Group Review, Germany]	This is true. Details of this unbalance are discussed in the following chapters
18175	1	7	1	7	1	Likewise, ocean surface gravity waves should be included here. Many possible references exist, but e.g. Babanin, 2006: On a wave-induced turbulence and a wave-mixed upper ocean layer. Geophys. Res. Lett. 33. L20605. [APECS Group Review, Germany]	Thank you for the comments, and 'wave dynamics' have been included into the text.
16655	1	7	4	7	41	I understand that snow is a transverse component which explains why it is not featured in a given paragraph (this makesit omewhat hidden, though), but I miss elements about the fact that some cryospheric elements (glacier, snow, permafrost) are a source of natural hazard, and also the fact that they are an economic ressource besides water and energy resources. This does not seem very balanced. [Samuel Morin, France]	A paragraph on snow has been added.
18355	1	7	4	8	13	I think it would be good to have a short paragraph on icebergs and claving here. This is mainly because of recent attention of calving of Larsen C iceshelf. [APECS Group Review, Germany]	Rejected. Would be nice to have but we have space limitations.
25885	1	7	5	7	5	definition is not quite correct / consistent with AR5: snow/ice in the atmsophere is typicaly excuded and frozen ground belongs to the cryosphere even if there is no water/ice involved. I suggest "The cryosphere refers to the portions of the Earth that are frozen. This includes glaciers and ice sheets, ice .... (term mountain glacier should be avoided, and the geographic location of the ice sheets seems not relevant here - such information is not given for the other components). [Regine Hock, United States of America]	Agreed and changed. The official definition of the cryosphere is given (copied from the glossary)
30307	1	7	5	7	5	Please refrain from using a stand-alone pronoun without a clear antecedent. [Paul Glaser, United States of America]	Text has been revised. "This" includes has been remove.
32043	1	7	5	7	5	Note that permafrost does not necessarily needs to contain ice. Accordingly, your definition of the cryosphere is not correct as it stands. An inclusive definition can be found in Allison et al., accepted, https://doi.org/10.5194/hgss-9-1-2018: [The cryosphere] collectively describes the components of the Earth's surface that contain ice, including snow, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost and seasonally frozen ground. Permafrost, however, can be "dry" and therefore the cryosphere also includes any natural material in frozen form. [Charles Fierz, Switzerland]	Agreed. We modified our definition accordingly
12055	1	7	5	7	6	This section states that "The cryosphere refers to components of the Earth system that contain frozen water. This includes mountain glaciers, the ice sheets of Greenland and Antarctica, ice shelves, sea ice, permafrost, and snow". However, the cryosphere should also include the elements of river ice and lake ice. So it is suggested to check and further clarify what it means in this report, and add it in the Glossary. [Government of China, China]	Agreed. A new definition of the cryospher has been given with the inclusion of lake and river ice.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16455	1	7	5	7	6	in AR4 but also in AR5 a clear distinction was made between frozen ground and permafrost. Is this given up here? [Georg Kaser, Austria]	A new definition of the cryosphere has been give,same than in the glossary., with the clear distinction between frozen ground and permafrost
16457	1	7	5	7	6	Also river and lake ice are important components e.g. of the (mainly Arctic) Cryosphere. [Georg Kaser, Austria]	Agreed: River and like ice have been added.
30479	1	5	7	5	29	Please remove references to FAQs [Hans-Otto Poertner and WGII TSU, Germany]	Agreed
22181	1	7	8	7	8	"Cryosphere is common in the Polar Regions..." My suggestion from the first order draft has not been followed here, so I will repeat it:This is not grammatically correct. Suggest rewording this as: "Cryospheric components are common in the Polar Regions..." [Inga Smith, New Zealand]	Agreed and modified
27497	1	7	12	7	16	I think it is worth mentioning at the end of this paragraph that a warming climate will give more precipitation/snowfall that since text already mentions "more vulnerable to rapid and irreversible ice loss". Many people seem surprised by reported high precipitation values in Greenland for example, even thoguh this would be exactly as espected under a warming climate. [Ruth Mottram, Denmark]	Agree. Added such a sentense in this paragraph
26293	1	7	13	7	16	This wording is confusing; ice sheets are not necessarily marine-terminating, and it is not clear that marine-terminating ice sheets or glaciers are substantially more vulnerable than their terrestrial counterparts. [Ethan Pierce, United States of America]	We agree that ice sheets are normally not marine terminating, but those who are, have the potential to retreat much faster. This was only used an example for the large portion of East Antarctica with a potential of 5-6 m SLR.
32823	1	7	14	7	16	If there is a later figure, box, etc., that provides a more detailed description of the marine ice sheet instability (i.e., why marine ice sheets are more vulnerable), it would be good to reference / point to it here. [Government of United States of America, United States of America]	Ice sheet instability is discussed in chapter 4, under Antarctica.
16459	1	7	18	7	21	This definition does not correspond with the glossary definition. Particuarly the statement that glaciers may also be maintained by ice flow from ice sheets needs better explanation, either here, in the glossary or both. [Georg Kaser, Austria]	Text has been revised and the combination of glaciers with ice sheets has been deleted
17231	1	7	18	7	21	I think that perhaps the flow would improve if the second and third sentences in this paragraph were reversed with one another. [Andra Garner, United States of America]	Disagreed. We prefer the current text structure.
25887	1	7	18	7	21	I find this paragraph somewhat confusing for a reader, e.g. if glaciers are suddenly parts of ice sheets. Given the confusion in the literature perhaps one should define the terminology used in this eport: Replace sentence L18-19 by "Following AR5 all other land ice masses other than the ice sheets are referred to as 'glaciers'. Glaciers are typically found in the polar regions and high mountains." [Regine Hock, United States of America]	Agreed Text has been revised and the combination of glaciers with ice sheets has been deleted
28315	1	7	19	7	19	lose? Do you mean loose? [Anne GUILLAUME, France]	We mean "lose" in a quantitative sense - less mass.
26295	1	7	19	7	20	It is possible for ablation processes to dominate on a glacier without necessarily contributing to sea level rise. [Ethan Pierce, United States of America]	Rejected. If a glacier is dominated by ablation, the mass balance will be negative which ultimately leads to SLR. You do have a good point that that melt water might never reach the ocean but that would be too detailed to mention here.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25889	1	7	20	7	20	Seasonal snow should not just be squeezed in here in the glacier/ice sheet section. It deserves its own paragraph including more information. [Regine Hock, United States of America]	Agreed. We added a new paragraph on snow in this chapter
1263	1	7	23	0		I would delete the word 'polar' so the sentence says "Ice shelves are extensions of ice sheets and glaciers that float in the surrounding ocean." The sentence is shorter and there is less of an implication that ice shelves are dependent on polar water. The Patagonia Ice Sheet was a mid-latitude ice sheet (located over Chile) that existed in the LGM that likely had ice shelves on it. [Jacinta Clay, United States of America]	Agreed, we removed "polar" in this sentence
25891	1	7	25	7	26	it may not be clear to a reader what this means. I suggest to be more explicit, e.g. "but ice shelves restrict the flow os land-based ice into the ocean and thus indirectly affect sea-level" [Regine Hock, United States of America]	We revised this sentence to be clearer to the reader
26297	1	7	25	7	26	“Buttressing” is a more concise word to describe this process, and is more common in the literature. [Ethan Pierce, United States of America]	We revised this sentence accordingly
32825	1	7	25	7	26	Could help to clarify and link back to the concept of "grounding line" if it was written as: "... but laterally confined ice shelves restrict the flow of ice past the grounding line, into the ocean." [Government of United States of America, United States of America]	Good point. We added the "past the grounding line".
22183	1	7	28	7	28	"Sea ice forms by the freezing of seawater at the ocean surface..." My suggestion from the first order draft (where this said "Sea ice forms from freezing of the sea surface") has only been partially followed, so I will repeat the relevant part of the comment here: This is not correct, as some sea ice forms at depth (see Langhorne et al., 2015; Mager et al., 2013). Suggest rewording this as: "Sea ice forms from freezing of sea water" References: Langhorne, P.J., Hughes, K.G., Gough, A.J., Smith, I.J., Williams, M.J.M., Robinson, N.J., Stevens, C.L., Rack, W., Price, D., Leonard, G.H., Mahoney, A.R., Haas, C., and Haskell, T.G. (2015). Observed platelet ice distributions in Antarctic sea ice: an index for ocean - ice shelf heat flux. Geophysical Research Letters, 42(13): 5442-5451, doi: 10.1002/2015GL064508. Mager, S.M., Smith, I.J., Kempema, E.W., Thomson, B.J., and Leonard, G.H. (2013). Anchor ice in polar regions. Progress in Physical Geography, 37: 468-483, doi: 10.1177/0309133313479815. [Inga Smith, New Zealand]	Agreed, as frazil ice forms at some depth and not at the surface, we have revised the text accordingly
30309	1	7	28	7	35	Combine this short paragraph with the one between lines 12-16. I suggest keeping like elements together and combing some of the very short paragraphs with only two sentences. [Paul Glaser, United States of America]	Rejected. We prefer to keep the ice sheets and sea ice separate,and have glaciers and ice shelves mentioned in between.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22185	1	7	29	7	30	"Sea ice may be discontinuous pieces moved on the ocean surface by wind and currents, or a motionless sheet attached to the coast (land-fast ice). " - This is identical wording to the first order draft, so I repeat my comment on it here: This is not quite complete or correct. Suggest rewording this as: "Sea ice may be discontinuous pieces moved on the ocean surface by wind and currents (pack ice), or a motionless sheet attached to the coast or to ice shelves (fast ice). " [Inga Smith, New Zealand]	Thank you again - good point. We revised the text accordingly.
22187	1	7	30	7	35	This sentence is a vast improvement on the one in the first order draft (where it was on page 8, lines 5 to 8). However, it only mentions the "livelihoods of people in the Arctic", and does not acknowledge the cultural importance of sea ice. It is already a long sentence, but I suggest changing "livelihoods of people in the Arctic" to "economy, life-styles, cultural identity, self-sufficiency, indigenous knowledge and local knowledge and skills of people in the Arctic" to align with the polar regions section of the Integrative Cross Chapter Box 7 (page 4, lines 10 to 11). [Inga Smith, New Zealand]	Good point, we added the statement that sea ice is crucial for transportation for predominantly Indigenous peoples
17273	1	7	31	7	32	In describing sea ice, the piece noting that it "supports the livelihoods of people in the Arctic" should be followed to qualify that these people are predominantly Indigenous peoples, and that sea ice is the foundation for many Arctic Indigenous cultures, specifically Inuit. The importance of sea ice to Inuit cannot be understated. For additional understanding of this, the Inuit Circumpolar Council has various reports that focus directly on sea ice such as 'The Sea Ice is our Highway' and 'The Sea Ice Never Stops'. [Joanna MacDonald, Canada]	Good point, we added the statement that sea ice is crucial for the Inuit culture.
25893	1	7	32	7	32	replace 'albedo' by 'albedo effect' otherwise not quite correct [Regine Hock, United States of America]	revised
8711	1	7	32	7	34	it' should appear after semi-colons [Nina Hunter, South Africa]	revised
30311	1	7	33	7	34	Does the formation of deep salty bottom water actually "drive" ocean circulation patterns or is it one critical link among a series of processes that includes, heating of oceanic surface waters in the tropics, wind stress, and changes in water density? [Paul Glaser, United States of America]	Agreed, we changed the term "drives" with "supports" global deep ocean exchange
16461	1	7	37	7	37	it seems confusing to add the term "permanetly frozen ground" if the "non-permanently frozen ground" is not dealth with. [Georg Kaser, Austria]	This paragraph has been re-written and permanently frozen has been omitted.
21583	1	7	37	7	37	Omit ", or permanently frozen ground," as 'frozen' implies the presence of ice, whereas the definition given is based on temperature. [Stephan Gruber, Canada]	This paragraph has been re-written and permanently frozen has been omitted.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18247	1	7	37	7	41	A scientific reference for how permafrost is defined would be helpful here since I think there are some competing definitions. See, for example Subcommittee, P. (1988). Glossary of permafrost and related ground-ice terms. Associate Committee on Geotechnical Research, National Research Council of Canada, Ottawa, 156. [APECS Group Review, Germany]	The permafrost is defined in the glossary and the definition has been added to the frist sentence of this paragraph
26299	1	7	37	7	41	The permafrost introduction should mention processes, such as the release of sequestered methane, associated with permafrost melt. [Ethan Pierce, United States of America]	Good point, we have added the greenhouse gas release from permafrost
30529	1	7	37	7	41	Might be worth mentioning permafrost as carbon store and the release of co2 and methane with thaw [Hans-Otto Poertner and WGII TSU, Germany]	Good point, we have added the greenhouse gas release from permafrost
16657	1	7	41	7	41	The statement on thermal insulation of snow cover, while true, seems a bit out of place here and may not mean much to the non-expert reader of the Box 1.1 in terms of the implications of this statement. [Samuel Morin, France]	This paragraph on permafrost has been re-written and lo longer includes the thermal insolation
21585	1	7	41	7	41	"coastal erosion and in mountain areas where permafrost thaw can lead to mass movements with far-reaching consequences." It would be good not to exclude mountains from this summary sentence. [Stephan Gruber, Canada]	This paragraph has been revised and includes landslides as a hazard which alludes to mountains
1929	1	8	0	8	1	Box 1.1, Figure 1: I suggest some few changes in the illustration: (1) the river looks like flowing down and uphill; (2) permafrost usually does not sit in the middle of a mountain slope, but from high elevations downhill; (3) mountain-top glaciers are common in the tropics and some arctic areas, but valley glaciers starting from just below the high peaks are the more common cases. [Harald Pauli, Austria]	Thank you for the comment, and they have been taken into account.
21641	1	8	0	8		In Box 1.1, Figure 1, it is difficult to understand all the contents to be shown though some explanations are included in the following sentences. In particular, it is difficult to accurately meaning the contents of water, energy and carbon cycles. therefore, it is necessary to revise the figure or supplement the explanation. [Government of Republic of Korea, Republic of Korea]	Thank you, and the figure and figure caption has been substantially revised to increase clarity.
22219	1	8	0	8		Fig.1.1: The depiction of sea ice is confusing: it seems more like a group of icebergs. It inadvertidely contributes to perpetrate the popular error of thinking that sea ice are icebergs. [Sergio Henrique Faria, Spain]	We fully agree with your concern. This figure will be revised and hopefully meets your standard. It is difficult to get a 3-D view on a small feature.
22615	1	8	0	8		In Box 1.1, Figure 1, it is difficult to understand all the contents to be shown though some explanations are included in the following sentences. In particular, it is difficult to accurately meaning the contents of water, energy and carbon cycles. therefore, it is necessary to revise the figure or supplement the explanation. [IN-SEONG HAN, Republic of Korea]	Thank you: The figure and figure caption has been substantially revised to increase clarity.
22995	1	8	0	8		Missing information on characteristic time scales, frozen lakes and rivers. The box is too qualitative and does not enough convey an idea of what is new since AR5. [Valerie Masson-Delmotte, France]	Agreed, we added frozen lakes and rivers. The framing chapter remains less quantitative because we given instructions to reframe from any assessment. Our first draft had included more quantitative statements
1265	1	8	1	0		Would it benefit the image if there be a positive arrow from an industrial symbol (the airplane, boat or buildings) indicating that human activity is connected to the carbon cycle? [Jacinta Clay, United States of America]	The figure has been revised and no longer shows fluxes nor planes.
1267	1	8	1	0		Since the water cycle is schematized, should sea level rise be reflected as well, perhaps on the area above the "continental shelf" label. "Sea Level (up arrow)" would be a sufficient way to represent it [Jacinta Clay, United States of America]	Thank you for the comment, and the figure has considerably changed.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1271	1	8	1	0		The image is already quite full, but it is unclear if the fish image represents ocean fish populations or all ocean ecosystems (a label with a up-arrow/down-arrow would be helpful). Additionally, if the fish image represents only fish, maybe another image should be added for corals with a corresponding down arrow. [Jacinta Clay, United States of America]	Thank you. Fish were removed in the figure.
14891	1	8	1	0		Figure 1 in Box 1.1: the picture seems valuable for a first overview on the multitude of components which are needed to describe the relation between ocean, cryosphere and climate change. Thus it may also be an interesting add-on for the SPM. However, the connection to human impact is unclear. [Government of Germany, Germany]	Thank you for the comment, and we have considerably improved the representation of the human component. Anthropogenic forcing elements however have been removed as the figure now only depicts ocean and cryosphere characteristics.
31555	1	8	1	0		Box 1.1, Figure 1. In regards to the icons that represent human activities, the caption explains that these are examples of human activities that "directly interact with and impact the energy budget, and the water and biogeochemical cycles". In this sense, perhaps the fishing boat, assumingly representing extractive activities, is not a relevant example because this activity is rather impacted by changes in O&C, but would hardly excert any impact on the cycles themselves. [Hans-Otto Poertner and WGII TSU, Germany]	Thank you for the comment, and Figure 1 has been considerably changed, and the fishing boat is now removed.
58	1	8	1	8	1	Box 1.1, Fig. 1. caption needs to include explanation of the little up and down arrows. [Baylor Fox-Kemper, United States of America]	"Due to the figure change, this comment is not applicable anymore.
60	1	8	1	8	1	Box 1.1, Fig. 1.. Fish should have a little downward arrow indicating biomass loss [Baylor Fox-Kemper, United States of America]	Due to considerable change of the figure, the fish had been removed.
62	1	8	1	8	1	Box 1.1, Fig. 1. Ocean circulation should have a little downward arrow indicating AMOC slowdown [Baylor Fox-Kemper, United States of America]	AMOC slowdown has been not reported in previous IPCC reports, and is thus not listed in the framing chapter as change.
64	1	8	1	8	1	Box 1.1, Fig. 1.. sizes of the flux arrows between reservoirs seem to indicate magnitudes, which should be explained in caption. [Baylor Fox-Kemper, United States of America]	"In the modified version, the flux arrows are not different anymore, thus comment not applicable
66	1	8	1	8	1	Box 1.1, Fig. 1. Emissions from factories and transportation should be noted, and a little upward arrow should note their continuing increase [Baylor Fox-Kemper, United States of America]	Anthropogenic forcing has been removed from the figure
654	1	8	1	8	1	It could be helpful to add the abyssal plain to the schematic. [Mengxi Wu, United States of America]	
3135	1	8	1	8	1	It may be helpful to provide numerical values for the transport of energy, water and carbon between the different reservoirs shown in the diagram. This could be done either near the corresponding arrows on the diagram, or in the caption. [Sloane Garelick, United States of America]	Thank you for the comment. This figure is a schematic illustration as part of the framing chapter, and will thus not contain quantification values.
3445	1	8	1	8	1	It is confusing to have depictions of societal elements like factories and cities without any arrow of carbon source from them - the carbon cycle is depicted as just between permafrost and the ocean. [Patrick Orenstein, United States of America]	Thank you for the comment. The carbon forcing is not part of the revised figure anymore.
4315	1	8	1	8	1	The arrow for the ocean circulation pattern is misleading. Why should there be upwelling on the left side and downwelling on the right side of the ocean basin? Please redraw. [The UBern Team Group Review, Switzerland]	Thank you for the comment, and the circulation has been modified.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11809	1	8	1	8	1	Include methane hydrates on figure. [William Lorenz, Australia]	Thank you for the comment, but figure is now focussed on ocean and cryosphere characteristics only.
16463	1	8	1	8	1	putting the permafrost on a mountain slope ignores the large extent of arctic permafrost. It is a general problem of this cartoon that the Arctic does basically not exist. [Georg Kaser, Austria]	Thank you. We have modified the figure accordingly.
17275	1	8	1	8	1	Box 1.1., Figure 1 - In this figure, the only place where people are depicted is near the cities and built infrastructure. It's important for the reader to understand that there are also people on the sea ice and in the mountains. As such, this figure could be enhanced by adding people to these parts of the graphic (ie. on the sea ice, in the mountains). While it may seem like a small thing, it is an important consideration in how IPCC is (or is not) representing people, particularly Indigenous Peoples, who live on the land and in these areas. [Joanna MacDonald, Canada]	Thank you, and we have now added these changes into the figure.
18155	1	8	1	8	1	I think a legend in the lower-left corner could be very helpful for distinguishing the meaning of the arrows in circles versus the curved colored arrows. It took me a long time to figure out that the former were indicating the direction of long-term change. [APECS Group Review, Germany]	The figure has been considerably changed aiming to increase clarity, and the comment/suggestion is hence not valid anymore.
18157	1	8	1	8	1	I'm not quite sure what to make of the linking lines connecting the flux arrows. Over the ocean, it's pretty clear that the inward flux of carbon is higher and the outward flux. It also looks like the ocean carbon reservoir is being linked directly to the permafrost, suggesting the exchange is only with permafrost. However, for energy and water, the linking line goes to nowhere in particular... is that meant to encompass the entire terrestrial realm? If so, it's inconsistent to omit the rest of the terrestrial realm for carbon. Because permafrost has a more obivous carbon link than the other cryospehre components, I can understand being partiuclar there. However, on the right-hand side of the diagram, the interactions with the ocean appear to only be with the ice sheet. Sure, ice shelves are extensions of ice sheets, but sea ice is it's own thing, so that's awkward to me. I'd rather see either a) a split in the linking lines to connect to *every* relevant reservoir or b) an obviously general link for water and energy, at least, if not also carbon. [APECS Group Review, Germany]	The figure has been considerable changed, and changes in ocean and cryosphere systems are outside the schematic now. Changes in the cycles are not included anymore as the figure focusses on the characteristics only.
32827	1	8	1	8	1	It would be helpful to indicate in the caption that the arrows (up/down) attached to various processes are indicating current (or anticipated?) trends in those processes (e.g., sea ice volume is / will be decreasing). [Government of United States of America, United States of America]	The figure has changed, and comment is thus not valid anymore.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
526	1	8	1	8	11	The schematic could be improved. The arrows (both meaning in terms of up or down, and also the size for the air-sea fluxes) is not mentioned in the caption. I do not understand the purpose of the buildings, boats and islands, as they are not mentioned. If they are meant to emphasize the importance of coastal regions, this would be a good place to include some of the numbers mentioned in the text. The arrows representing change could also have values and certainty next to them. [Jenna Pearson, United States of America]	The schematic has been modified, aiming to clarify. Buildings, boats etc have been removed.
17233	1	8	1	8	13	Parts of this schematic are quite good--the differently sized and colored arrows to show the linkages and movement of energy, water, and carbon, as well as the arrows showing the general trends in ice sheets, ice shelves, etc., are all clean and easy to understand. However, the anthropogenic influences don't seem to be fully tied in to the broader schematic yet. Right now, they feel like they were an afterthought just quickly drawn onto the figure. I think something further is needed on the figure to show readers precisely where and how these activities impact the energy budget and water and biogeochemical cycles that are illustrated here. [Andra Garner, United States of America]	The figure has changed considerably, and only focuses on the ocean and cryosphere characteristics - changes are shown apart. The comment is thus taken into account, and is one of the reasons why a considerable change of the figure is introduced.
34225	1	8	1	8	5	The figure could be more selfexpnatory by indicating the compartiments and the main processes impacted by climate change more clearly. [Maria Jose Sanz Sanchez, Spain]	The schematic has been modified, aiming to clarify.
652	1	8	1	8	8	Does the size of the arrows matter? It is not very clear from the figure caption. [Mengxi Wu, United States of America]	The figure is only a shematic illustration, however, it has significantly change to increase clarification.
1587	1	8	1	8	8	In the figure caption clarify that black circles with white arrows indicate an effect whereas the arrows (back, blue, and red) indicate fluxes. It is not clear from this figure how human processes directly impact the energy budget, water and biogeochemical cycles. [Nora Richter, United States of America]	The figure is only a shematic illustration, however, it has significantly change to increase clarification.
18191	1	8	1	8	8	I think that this graphic could be improved by indicating that clouds are highly variable and complex. Ocean temperatures are an essential part of deep convection and there is a great deal of work underway looking at how the organisation of clouds is related to the temperature of the surface ocean (e.g. Holloway and Coauthors, 2017: Observing Convective Aggregation. Surveys in Geophysics. 38(6) 1199-1236). In short, presenting a band of homogenous, thick clouds is not useful and is misleading. [APECS Group Review, Germany]	Clouds have been removed from the figure, as focus only on ocean and cryosphere.
22431	1	8	1	8	8	Suggest non-CO2 GHGs be included in the Figure also, since around 20% of warming to date is related to non-CO2 GHGs. [Government of Australia, Australia]	Forcing factors have been removed from the shematic map, focus only on ocean and cryosphere characteristics.
22433	1	8	1	8	8	Suggest including a definition of 'Energy' so as not to confuse various other entities, such as carbon, electricity, fuel, heat etc. [Government of Australia, Australia]	Agreed: Energy has been changed to heat.
1269	1	8	3	0	8	I assume that the relative size of the arrows indicate the overall flux of the water/energy/carbon, but it would helpful if the caption said so explicitly [Jacinta Clay, United States of America]	The flux arrows have been removed from the figure, as focus only on ocean and cryosphere.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25895	1	8	3	8	3	caption: add after 'cryophere' "(direction indicated by arrows)" [Regine Hock, United States of America]	The figure is only a schematic illustration, however, it has significantly change to increase clarification.
25915	1	8	3	8	3	There are arrows only for emitted infrared and incoming solar radiation. This is misleading. Either add all components (both components have an outgoing component (reflected for solar rad), or make clear that this is 'net' [Regine Hock, United States of America]	The energy imbalance has been removed from the figure, as the focus is now only on the characteristics and changes of the ocean and cryosphere
30313	1	8	3	8	8	The illustration in Box 1.1 is missing bidirectional fluxes of carbon between the terrestrial environment and the atmosphere/ocean are missing from this figure. I think it is OK to ignore all but the major fluxes between these large reservoirs for the sake of simplicity. [Paul Glaser, United States of America]	The flux arrows have been removed from the figure, as focus only on ocean and cryosphere.
25897	1	8	5	8	5	caption: delete 'OHC' (Avoid acronyms - this is one is not even used a single time thereafter) [Regine Hock, United States of America]	Thank you, we have removed the acronym.
25899	1	8	6	8	6	caption: rearrange order for better logic: 'ice sheets, glaciers, snow cover and permafrost [Regine Hock, United States of America]	Thank you, taken into account
1589	1	8	14	8	14	In the section title, consider replacing "Geochemical Cycle" with "Biogeochemcial cycle" since that is what is discussed in the remainder of the section. [Nora Richter, United States of America]	Thank you, and taken into account.
32829	1	8	14	9	52	Very good summary of interactions between the oceans and cryosphere and how they regulate the Earth's climate in Section 1.2. [Government of United States of America, United States of America]	Thank you very much.
18141	1	8	16	9	27	C4: There is no information on the role of the cryosphere in the geochemical cycle. [APECS Group Review, Germany]	Agreed: we have added text on that topic for permafrost. Bio-chemical properties of run-off from snow, glaciers, and permafrost have been dmentioendf in Chapter 2, but not discussed in detail. Other geochemical cycles are very slow such as the evolution of Canadian and Fennoscandian Shield groundwaters and have not been discussed in this report.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18197	1	8	16	9	27	I think section is under-done. Reading it, one doesn't get close to the sense that the ocean and atmosphere are so fundamentally coupled and changes in one leads to profound changes in the other. It is my opinion that explaining how the atmosphere dynamically forces the ocean, and the ocean thermodynamically forces the atmosphere is of the utmost importance. Non-scientistics reading this report may well struggle to link changes in ocean surface temperature to 'life on land'. However the meridional temperature gradient and SST anomalies are a fundamenal control on the large-scale atmospheric circulation (for example the jet stream and the extent of the tropics, e.g. Thomson and Vallis, 2018a: Atmospheric Response to SST Anomalies. Part 1: Background-State Dependence, Teleconnections, and Local Effects in Winter. Journal of Atmospheric Sciences. Thomson and Vallis, 2018b: Atmospheric Response to SST Anomalies. Part 2: Background-State Dependence, Teleconnections, and Local Effects in Summer. Journal of Atmospheric Sciences.). This means that changes in the sea surface temperature have a profound effect around planet. Likewise, there is no real sense of the thermodynamic consequences of sea-ice loss. Recent work has shown that sea-ice loss invokes an atmospheric response similar to the North-Atlantic Oscillation (Screen, Bracegirdle, and Simmonds, 2018: Polar Climate Change as Manifest in Atmospheric Circulation. Current Climate Change Reports. 4(4) 383-395.). This profoundly controls the weather and climate of Europe. It is my opinion that including this will substantially improve the impact of this section. [APECS Group Review, Germany]	Noted. Thank you for these comments, and for the references. The main focus in the framing chapter is on ocean and cryosphere Earth system components, and we already include their interactions. To highlight their important role within the Earth system - and in interaction with other components of the Earth system, the link through the Energy, Water and Carbon cycle is framed. We thus include interactions with the atmosphere as also shown in Figure 1.1.
1303	1	8	18	0		I find the phrase "Powered by the sun" confusing. Maybe "powered by the sun's energy". Alternatively the phrase could be removed entirely. [Jacinta Clay, United States of America]	Thank you, taken into account.
29593	1	8	18	8	18	I first want to compliment the Authors for capitalizing "Earth" when referring to the planet--that is the right choice, in my view, to insist upon given it is a specific celestial body and "Earth" is used as its official name rather than "Terra", which some suggest is really the official name even though virtually no one uses that name. My Question is why "Sun" is not capitalized when referring to the particular star that powers our solar system; yes, "Sol" may be the official name, but no one refers to it as that. So, please consider capitalizing "Sun" when referring to our home star. [Michael MacCracken, United States of America]	Thank you, taken into account.
3143	1	8	18	8	31	It may be helpful to provde a quantitative context for the processes discussed here so that there is an established baseline from which we can compare changes in the water, energy and carbon cycles in the ocean and crysophere in order to better identify changes to these systems as a result of warming [Sloane Garelick, United States of America]	Taken into account. More quantitative context is given in the following chapters, as chapter 1 task is to deliver the framing only.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18133	1	8	18	8	31	E1a: Overall the paragraph lacks continuity, sentences are disconnected, its not really cohesive as the other paragraphs in section 1.2.2. Maybe the section would benefit on a full stop, new paragraph, after "...including between the ocean and cryosphere (Box 1.1, Figure 1)." [APECS Group Review, Germany]	Accepted.
22997	1	8	21	8	21	The notion of stable climate states is quite theoretical (compared to lessons from paleoclimate) [Valerie Masson-Delmotte, France]	Accepted, stable is removed.
30315	1	8	23	8	23	Change "At Earth's surface" to "At the Earth's surface," [Paul Glaser, United States of America]	Taken into account.
18135	1	8	23	8	25	E1a: This sentence is hard to read. First the examples of different types of energy are not exemplified directly or their relevance explicited, thus they become anecdotal and seems they could be avoided. Secondly, in the examples of the diverse types process controlled by energy from the sun, the first one: "which evaporate water" in line 24 I think could be left out, it seems pretty specific compared to "drive weather systems in the atmosphere and currents in the ocean" and "fuel photosyntesis on land and the ocean". The meaning of the sentence would benefit from leaving "which evaporate water" out or rephrase it to become as general as the other two examples. [APECS Group Review, Germany]	Thank you, change taken into account.
13723	1	8	26	8	26	Text states 'The ocean has a large capacity to store and release heat from the atmosphere'. Should this read 'from and to the atmosphere'? The text is not clear on where the heat is released. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Change applied and rephrased.
17487	1	8	28	8	31	Add to the last sentence: "...resulting in a climate change feedback, which can greatly accelerate warming that is magnified in the polar regions through arctic amplification." [Kristin Campbell, United States of America]	Duplicated comment. Taken into account. Change has been made
17587	1	8	28	8	31	Add to the last sentence: "...resulting in a climate change feedback, which can greatly accelerate warming that is magnified in the polar regions through arctic amplification." [Durwood Zaelke, United States of America]	Duplicated comment. Taken into account. Change has been made
26301	1	8	29	8	31	Land use and land cover changes are an important component of Earth's albedo, worth mentioning in this section. [Ethan Pierce, United States of America]	Noted. The change the reflectiveness of land is mentioned in the text. However, due to limited space we are unable to list specifically the reasons for change in surface reflectiveness and the role of vegetation.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24373	1	9	2	9	10	A concise way to link to the challenges in terms of cascading and intertwined changes in the hydrological cycle could be to refer to key references from International Association of Hydrological Sciences: Montanari A., Young G., Savenije H., Hughes D., Wagener T., Ren L., Koutsoyiannis D., Cudennec C., Grimaldi S., Blöschl G., Sivapalan M., Beven K., Gupta H., Arheimer B., Huang Y., Schumann A., Post D., Taniguchi M., Boegh E., Hubert P., Harman C., Thompson S., Rogger M., Hipsey M., Toth E., Viglione A., Di Baldassarre G., Schaefli B., McMillan H., Schymanski S., Characklis G., Yu B., Pang Z., Belyaev V., 2013. "Panta Rhei – Everything Flows": Change in hydrology and society – The IAHS Scientific Decade 2013-2022. Hydrological Sciences Journal, 58, 6, 1256-1275, DOI: 10.1080/02626667.2013.809088 McMillan H. Montanari A. Cudennec C., Savenije H., Kreibich H., Krueger T., Liu J., Meija A., van Loon A., Aksoy H., Di Baldassarre, G., Huang Y., Mazvimavi D., Rogger M., Sivakumar B., Bibikova T. Castellarin A., Chen Y., Finger D., Gelfan A., Hannah D., Hoekstra A., Li H., Maskey S., Mathevet T., Mijic A., Acuña A., Polo M., Rosales S., Smith P., Viglione A., Srinivasan V., Toth E., van Nooijen R., Xia J., 2016. Panta Rhei 2013-2015: Global perspectives on hydrology, society and change. Hydrological Sciences Journal, 61, 7, 1174-1191, http://dx.doi.org/10.1080/02626667.2016.1159308. Cudennec C., Gelfan A., Ren L., Slimani M., 2016. Hydrometeorology and Hydroclimate. Advances in Meteorology, ID 1487890, 4 p, http://dx.doi.org/10.1155/2016/1487890 [Christophe Cudennec, France]	Noted. Thank you for this interesting reference, but chapter 1 is not assessing, it is framing.
26303	1	9	2	9	10	Are the citations in this section necessary? There are no claims being made, and the information here is common knowledge. [Ethan Pierce, United States of America]	Taken into acount. The number of references has been reduced.
25901	1	9	2	9	2	first part is repetition from box; it would be good to add here or in box the percentage of freshwater stored in the cryosphere (ca. 75% in glaciers/ice sheets) [Regine Hock, United States of America]	Taken into account. This information has been added.
1591	1	9	8	9	10	I feel likethe last sentence needs more citations. This sentence is also somewhat confusing. It seems to imply that changes in the crysophere and ocean can induce tropical cyclones related to extreme rainfall events. Please clarify. [Nora Richter, United States of America]	Taken into account. Thank you for the comment, which has greatly improved the sentence.
5237	1	9	8	9	10	" Hydrological extremes related to the ocean and cryosphere include floods from extreme rainfall (including tropical cyclones) or meltwater discharge, or ocean circulation-related droughts". This last part resalted in black would be trated separately and more explained because isn´t clear. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account. According to comment 1591, the sentence has been modified, thus replying to the reviewers comment.
18165	1	9	8	9	10	The paper cited only covers one of the concepts being listed in one region (ocean-related extreme precip in the Midwest USA); adding citations to papers that include cyrosphere-related and/or drought-related extremes would add better support -- or a more comprehensive/review paper perhaps. [APECS Group Review, Germany]	Taken into account. The reference has been removed, and only the links to the other chapters, where the assessments are performed, are given.

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25903	1	9	8	9	8	remove 'ice caps' for consistency with AR5 terminology [Regine Hock, United States of America]	Taken into account, thank you.
1273	1	9	12	0		The term "geological reservoirs" may be confusing to non-geologists. Perhaps "rocks" or "bedrock" would be a better term? [Jacinta Clay, United States of America]	Taken into account. We kept the term "geological reservoir", but added a descriptor to it.
30317	1	9	12	9	19	I disagree with the thrust of this paragraph. Only the upper ocean exchanges carbon freely with the atmosphere and the total carbon storage in this reservoir roughly approximates that it in terrestrial soils and the terrestrial biosphere combined. The organic content of terrestrial soils and the the terrestrial biosphere has been estimated to be about 2000 Pg C, which slightly exceeds that of the Surface Ocean (90 Pg C). Of course carbon storage is immense (37,000) in the Deep and Intermediate Ocean but these reservoirs only exchange carbon with the atmosphere on much longer and irregular time scales (Sundquist, E.T. and K. Visser (2005).The Geologic History of the Carbon Cycle. in W.H. Schlesinger Biogeochemistry, vol. 8 in Treatise of Geochemistry pp. 425-472. In the same volume R.A. Houghton estimated a slightly higher value for carbon storage in terrestrial soils and vegetation. (Houghton, R.A. The contemporary carbon cycle. in W.H. Schlesinger Biogeochemistry, vol. 8 in Treatise of Geochemistry, pp. 475-513). Some caveats are therefore needed and this entire paragraph needs to be revised [Paul Glaser, United States of America]	Taken into account. It is correct that the timescales associated with the deep ocean are multi-centennial. This is especially true in the deep Pacific below 1500 m. But many parts of the deep Atlantic, and the entire ocean above ~1500 m exchanges with the atmosphere on timescales of hundred years or less. This can be readily be seen by the deep penetration of e.g., anthropogenic heat and CO2 into the ocean's interior. Thus, even if we agreed that we need to reduce the effective reservoir in exchange with the atmosphere, the inventory of dissolved inorganic carbon would still be above 10'000 Pg C. According to IPCC AR5 (chapter 6) the terrestrial C reservoir (soil and vegetation) is about 2000 to 3000 Pg C with a very uncertain additional contribution of about 1700 Pg C from permafrost. Thus, the land C reservoir is still substantially smaller than that in the ocean. This is not to say that the land C reservoir does not matter - in fact, it matters a great deal, but this is not purview of this report here. We nevertheless made a small change to the text. We reduced the 92% number to 90%, since we previously did not take into account the contribution of permafrost.
18137	1	9	15	9	16	E2: I think the reference is not the best, it corresponds to modelling with time scales of millions of years and the role of the ocean in regulating the climate in centennial/millenial time scales seems more relevant for the anthropogenic climate change. A better reference could be Menviel et al., 2018. Menviel et al., 2018: Southern Hemisphere westerlies as a driver of the early deglacial atmospheric CO2 rise. Nature communications, DOI: 10.1038/s41467-018-04876-4. [APECS Group Review, Germany]	Taken into account: Thanks for the comment. The Berner reference indeed applies to very long time-scales. We thus added the Sigman & Boyle (2000) review paper. which explicitly discusses this issue.
18151	1	9	15	9	16	E1a: I think it is important to stress the shorter time scales in which the ocean's carbon cycle is relevant for Earth's climate, which is centenial to millenial timescales, by expliciting it in the text. [APECS Group Review, Germany]	Comment taken into account. It now reads: This represents a major control on atmospheric CO2 and makes the ocean and its carbon cycle one of the most important climate regulators in the Earth system, especially on timescales of a few hundred years and more
1593	1	9	17	9	19	For the sentence "Primary production in the ocean…" it might be useful to include the percentage of primary production that occurs in the ocean and land for a quantiative comparison. [Nora Richter, United States of America]	Comment rejected since the text already specifies the percentage, i.e., 50% ocean, 50% land.
34227	1	9	17	9	19	introduce more updated estimation of primary production (net and gross). [Maria Jose Sanz Sanchez, Spain]	Comment rejected: Adding gross production does not add any important new information here. The statement here about the magnitude of ocean and land primary production being equal is current.

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18139	1	9	22	9	25	E2: Talley et al, 2013 refers to the suduction of waters but not to the carbon transport, Sabine et al., 2004 could be a better reference for that. "...deeper layers of the ocean (Talley et al., 2013), taking high carbon concentrations with them (Sabine et al., 2004)." Sabine et al., 2004: The Oceanic Sink for Anthropogenic CO2. Science 305, 367-371. [APECS Group Review, Germany]	Comment taken into account. But we use the more recent publication by Gruber et al. (2019).
26925	1	9	23	9	23	add 'cool' to the higher density waters to show that the waters become higher density because getting cooler [Liz Dovey, Australia]	Thank you, much clearer now, comment taken into account.
30319	1	9	23	9	23	Is the production of dense ocean water actually the driver for ocean circulation rather than climate? If the polar regions were much warmer and lacked ice there would be no sea ice, ice sheets, or the production of dense ocean water. [Paul Glaser, United States of America]	In this subsection, characteristics, and not changes are introduced, and thus the comment is rejected.
32831	1	9	25	9	27	It might be appropriate here to also mention upwelling of nutrients from cold, deep waters, and/or exchange of those nutrients with shallow and surface waters. [Government of United States of America, United States of America]	Comment taken into account.
656	1	9	29	9	52	I wonder if the isotopic effect of ice volume change, particularly in the past, should be mentioned in this subsection. [Mengxi Wu, United States of America]	Rejected. Good point, but given the space limitation of this chapter we have to decline this recommendation.
25909	1	9	29	9	52	I miss the mentioning of the interaction between ice melt induced freshwater influx into the ocean and ocean circulation (e.g. papers by Royer and others for the Gulf of Alaska) [Regine Hock, United States of America]	Rejected: The paper by Royer states that the ocean freshening due to glacier melt and coastal discharge MIGHT cause some ocean circulation change, but this has not been verified yet.
3145	1	9	31	9	52	A brief summary of how these interactions are expected to change may provide context for the remainder of the chapter. [Sloane Garelick, United States of America]	Rejected. In a framing chapter we should provide the point of departure and explain what is coming in the subsequent chapters, but we should not do the assessment of possible changes.
1275	1	9	33	0	34	Since the interconnectedness of ocean and cryosphere is being described "Ocean volume changes as the ocean warms and expands, and as water stored on land (primarily as ice) is returned to the ocean" can be shortened to "Ocean volume changes as the ocean warms and expands, and as ice meltwater returns to the ocean" or even "Ocean volume changes as ice meltwater returns to the ocean" [Jacinta Clay, United States of America]	Taken into account. This sentence has been deleted to shorten this paragraph.
9475	1	9	34	9	37	We advice not to use the term « contain » which can lead to misinterpretations. [Government of France, France]	Taken into consideration and revised accordingly
9477	1	9	34	9	37	It would be striking to give the theoretical value of the level rise if all of the ice sheets were to melt. [Government of France, France]	Accepted: The potential SLR has been given based on the AR5 assessment.
13725	1	9	34	9	37	Text states 'although the majority is considered stable', is this referring to the ice sheets? This could helpfully be clarified. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into consideration. This sentence has been deleted to shorten this paragraph

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17489	1	9	34	9	41	This non-linear aspect of the ice sheets contributes to uncertainty about the timing and extent of their impact on sea levels, where increased warming leads to increased forcing that leads to increased spread of possibilities; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142 and Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8. [Kristin Campbell, United States of America]	Noted. Thank you for your feedback. This framing chapter cannot discuss the interesting points of non-linear responses and forcing. These details will be found in the following chapters 3 and 4.
17589	1	9	34	9	41	This non-linear aspect of the ice sheets contributes to uncertainty about the timing and extent of their impact on sea levels, where increased warming leads to increased forcing that leads to increased spread of possibilities; see Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142, 140–141 (“Nonlinearity has implications not just for the ensemble mean, but also for the spread of model projections. In general, an increased spread at higher forcing should be expected: the relative importance of nonlinear mechanisms grows with increasing forcing, so their contribution to model spread does likewise. Conceptually, this can be thought of as including an extra uncertain process at higher CO2 concentrations. This inflation in model spread at higher forcing is large when nonlinearities are uncertain, and seems to be especially relevant for change per kelvin of global warming.”); and Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8, 2 (“Nonlinear mechanisms are those inconsistent with linear system theory. These may include state-dependent feedbacks, such as the sea-ice albedo feedback (which vanishes for large or zero sea-ice cover). Nonlinear mechanisms can cause climate patterns to differ at different levels of forcing. For example, if an equivalent of RCP8.5 was run with double the forcing, linear mechanisms would show exactly double the response compared with the standard RCP8.5, but nonlinear mechanisms would not. Nonlinear mechanisms have been demonstrated in a few models for very high-forcing levels, or under idealized CO2-forced experiments, for global and regional-scale precipitation, warming and ocean heat uptake. In one model study using idealized experiments, nonlinear precipitation change over tropical oceans was associated with interactions between pairs of approximately linear mechanisms (for example, simultaneous moisture increases and circulation shifts). Nonlinear behaviour of the Indian Summer Monsoon associated with the positive moisture advection feedback has also been proposed.”). [Durwood Zaelke, United States of America]	Noted. Thank you for your feedback. This framing chapter cannot discuss the interesting points of non-linear responses and forcing. These details will be found in the following chapters 3 and 4. It is true that the sea ice feedback of albedo will vanish once the sea ice cover will disappear, but the ocean surface will absorb long-wave and sky-radiation and warm further, a much stronger feedback for the climate system then the albedo reduction of sea ice. However, this is not a non-linear process as you mentioned. Further, we know today very little about the non-linear feedback of precipitation increase or decrease in a warming climate in polar regions.
24931	1	9	35	9	35	tens of meters' can be put more precise [Frank Pattyn, Belgium]	Agreed: The values of the AR5 assessment has been quoted now.
26305	1	9	35	9	36	Get an updated citation on the long-term stability of ice sheets. If possible, differentiate between Greenland and Antarctica, both in terms of magnitude of potential sea level rise and long-term stability. [Ethan Pierce, United States of America]	Agreed: This paragraph has been modified with a more quantitative statement but no new references have been added since we are not making an assessment.

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2399	1	9	36	9	37	You write "The vast ice sheets in Antarctica and Greenland currently contain many tens of metres of potential global sea level rise (Fretwell et al., 2013; Frezzotti and Orombelli, 2014), although the majority is considered stable over long (century to millennial) time scales (Church et al., 2013)." The claim of an allegedly stable pre-industrial sea level is incorrect and does not represent the current scientific understanding. I am surprised that you are not citing Kopp et al. 2016 (doi: 10.1073/pnas.1517056113) who have published a very informative global sea level reconstruction for the past 2000 years and shows pre-industrial sea-level change of up to 150 mm. Authors suggest that this natural sea-level rise is temperature-driven, implying that pre-industrial global temperature has equally seen significant natural variability. [Sebastian Luening, Portugal]	Agreed: We have changed this paragraph and made more quantititive statement about Antarctica and time scales. WE no longer quote that the ice sheets were stable over long time scales. I enjoyed reading the paper of Kopp et al 2016, where they state that semiempirical modeling without global warming, very likely would have risen the GSL by between −3 cm and +7 cm, rather than the ~14 cm observed, or after the corrected hindcast projection was ~11 cm, with a 90% credible interval of 6.0–15.4 cm. We did not include this information in the framing chapter as we are not making an assessment.
29019	1	9	36	9	37	Suggest different wording here -- it implies stability even in the face of extreme temperature rise. Perhaps, "...although signficant loss would take centuries to millennia given the sheer volume of ice contained in these great ice sheets, even those with potential tipping points related to loss of altitude (Greenland) or bearing ice shelves (WAIS, some East Antarctic basins such as Wilkes)." [Pam Pearson, Sweden]	Accepted. The wording has been changed
25905	1	9	39	9	39	add: 'to OCEAN temperature' (the response is quite linear to air temperature) [Regine Hock, United States of America]	Accepted and changed accordingly.
32833	1	9	39	9	41	Does the "nonlinear response of ice shelf melt to temperature changes" require a supporting reference? If so: Holland, P. R., A. Jenkins, and D. M. Holland, 2008: The Response of Ice Shelf Basal Melting to Variations in Ocean Temperature. J Climate, 21, 2558, doi:10.1175/2007JCLI1909.1. [Government of United States of America, United States of America]	Accepted, reference added and text revised accordingly.
22999	1	9	41	9	41	Missing information on timescales for ice melt [Valerie Masson-Delmotte, France]	Rejected, it will be discussed in the following chapters. At the current rate of ice loss, Greenland needs 15'000 years to melt, however, with an acceleration of 300 it would take only 43 years (by 2050 the GIS would be gone). These speculations are better discussed in the relevant chapter. Chapter 1 should not quote an estimate as part of the framing.
17025	1	9	43	0		also mention something about "polynias" [Jorge Carrasco, Chile]	Noted but polynyas are discussed in Chapter 3, Box 3.2 in detail. There is not enough space in the framing chapter.
240	1	9	43	9	43	The use of word "drive" requires care as discussed in Appendix C (P.436) of Wunsch (2015) textbook ISBN 978-0-691-15882-2. Two everyday usages of the word are "controller" and "power source". It is not yet established that dense water production controls the global scale ocean circulation (possibly, e.g. doi:10.1016/j.ocemod.2005.04.001). It is still arguable if the polar cooling is the one of the main sources of the global circulation (e.g. doi:10.1175/2009JPO4162.1). Contribution from wind is crucial both in controling and providing power to the circulation. [Katsuro Katsumata, Japan]	Accepted, text has been modified accordingly.

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18177	1	9	43	9	43	It would be worth mentioning that this is through brine rejection and local radiative changes (albedo) [APECS Group Review, Germany]	Rejected. We mention the dense water formation which is the brine rejection.
18143	1	9	43	9	52	E2: Maybe it should also be mentioned how the sea ice extent around Antarctica is though to regulate global oceanic circulation cells ventilation (exchange of gases with the atmosphere) by modulating the depth of the deep waters upwelled in the Southern Ocean under sea ice (e.g. Ferrari et al., 2014). Ferrari et al., 2014: Antarctic sea ice control on ocean circulation in present and glacial climates. PNAS, 111 (24), 8753-8758. [APECS Group Review, Germany]	Noted. This is a good point but, unfortunately, the framing chapter can only paint a broad picture and not regional details. These details will be discussed in the following chapters.
25907	1	9	44	9	47	Unbalanced use of references: 4 references for Line 44 (are all needed?) but nothing for the next statement (L45ff). [Regine Hock, United States of America]	Agreed. References for the paleoclimate have been added.
26307	1	9	45	9	46	The paleoclimate claim should have an accompanied confidence level. [Ethan Pierce, United States of America]	This is very hard to give a uncertainty range, since it is based on modeling and there is no direct evidence.Noted.
4319	1	9	45	9	47	Maybe good to add here some references to the paleoclimatic evidence. [The UBern Team Group Review, Switzerland]	Agreed, two references were added
18343	1	9	45	9	47	Anong with this "Palaeoclimate evidence indicates……", what if we mention some reference or directly cite that evidence. [APECS Group Review, Germany]	Agreed, two references were added
23001	1	9	45	9	47	Why no paleoclimate reference here to support the statement? This is quite controversial, and some studies interpret data the other way round (changes in ocean circulation triggering ice sheet instability). Please check very carefully. [Valerie Masson-Delmotte, France]	Agreed, two references were added
4849	1	9	46	0		"resulting in rapid millennial-scale changes in global climate." - please specify what changes or refer to section where this gets explained further. [Debra Roberts and Durban Team, South Africa]	Accepted. We added the keyword: Dansgaard-Oeschger oscillations.
13727	1	9	46	9	46	Text states 'resulting in rapid millennial-scale changes'. Does this mean that the changes will be rapid and the consequences will last millennia? Or that the changes are rapid and will continue for millennia? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. We added the term describing these events: Dansgaard-Oeschger oscillations.
26927	1	9	46	9	46	can disrupt' - not clear how [Liz Dovey, Australia]	Accepted. The sentence has been expanded and clarified.
13729	1	9	47	9	48	Text refers to changes in surface ocean salinity and stratification but from this sentence it is not clear if the changes are positive or negative (or both depending on the situation). Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Added the Dansgaard-Oeschger oscillations, temperature increase of about 10 C in a few years.

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22189	1	9	47	9	48	"Glacier and ice sheet loss in polar regions can also cause changes in surface ocean salinity and stratification that promote sea ice formation (Purich et al., 2018)." This effect has only, to my knowledge, been attributed to the Antarctic. The first order draft had a substantial block of text (page 48, lines 32-43) on Antarctic sea ice extent, which looks like it has been removed to the polar regions chapter (which I think is a good idea). The Purich et al. (2018) paper is only one of many papers that have identified this possible mechanism, and the Purich et al. (2018) paper used pre-industrial forcings so may not be the most relevant paper to cite here. The proposed mechanism also has a number of caveats. I suggest re-wording this sentence to read as follows: "Glacier and ice sheet loss in polar regions may cause changes in surface ocean salinity and stratification that promote sea ice formation, particularly in the Antarctic (see Chapter 3)." [Inga Smith, New Zealand]	Accepted. The sentence has been modified as suggested
26929	1	9	49	9	49	exchange' - Is exchange the right word? - implies two way but aren't the nutrient flows are one way? [Liz Dovey, Australia]	Accepted. Text revised accordingly.
18171	1	9	51	9	52	This sentence states the positive effect of glacier melting on ocean productivity using an example from the Arctic. It may be worth including a study showing similar results on Antarctic waters to gain a polar or global perspective. For example (https://doi.org/10.1016/j.pocean.2019.01.005), the positive effect of glacier melting on coastal Antarctic waters due to iron supply and salinity stratification. [APECS Group Review, Germany]	Noted. Good point, but space limitation only enables to mention a few examples.
284	1	9	55	10	13	Could you provide more statsistics on Detection & Attribution? Such as: year that global temps broke out of natural variability envelope, or number of droughts attributed to climate change in a certain year? [Ethan Kyzivat, United States of America]	Taken into account: While such explicit statements are outside the scope of our scoping chapter, we nevertheless responded to this comment by adding a reference to box 5.1 in chapter5.
4321	1	10	1	10	1	Why hundreds or more years? The age of the deep North Pacific Ocean waters is more than 1000 years old. So I would change it to 'It takes hundreds to thousand years' [The UBern Team Group Review, Switzerland]	Taken into account: Text changed.
18145	1	10	1	10	1	E2: It takes thoushands of years for the entire deep ocean to turn over (Matsumoto,2007), the reference Buckley and Marshall (2016) relates to he variability of AMOC and Kuhlbrodt and Gregory (2012) is about ocean heat uptake not about deep ocean overturning times. Matsumoto, 2007: Radiocarbon-based circulation age of the world oceans. Journal of Geophysical Research, 112, C09004, doi: 10.1029/2007JC004095 [APECS Group Review, Germany]	Taken into account: Matsumoto reference added, the other two were deleted.
18179	1	10	1	10	1	I strongly suspect this term will be unclear to non-specialists. [APECS Group Review, Germany]	Rejected: unclear which term the reviewers refer to.
3147	1	10	1	10	17	This section discusses delayed responses and non-linear responses, but there is no discussion of the "linear, in sync with forcing" responses shown in Figure 1.1a. How does this response occur and what are some examples of linear systems? [Sloane Garelick, United States of America]	Taken into account: reformulated beginning of paragraph

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4161	1	10	1	10	2	I don't think the two references quoted for the global ocean overturning time are appropriate. I suggest: Doos, K., Nilsson, J., Nycander, J., Brodeau, L., Ballarotta, M., 2012. The World Ocean Thermohaline Circulation. Journal of Physical Oceanography 42, 1445-1460. and Gebbie, G., Huybers, P., 2012. The Mean Age of Ocean Waters Inferred from Radiocarbon Observations: Sensitivity to Surface Sources and Accounting for Mixing Histories. Journal of Physical Oceanography 42, 291-305. and England, M.H., 1995. The Age of Water and Ventilation Timescales in a Global Ocean Model. Journal of Physical Oceanography 25, 2756-2777. And in the sentence, I'd say 'It takes centuries to millenia for the entire...'. [Carles Pelejero, Spain]	Taken into account: Thanks for the helpful references. We added Gebbie and Huybers, 2012. We also added the "millenia" (see comment 4321)
528	1	10	1	10	8	This point should be highlighted more in the exectuive summary. [Jenna Pearson, United States of America]	Accepted: This is now included in the executive summary
14893	1	10	1	10	8	Deep Ocean and large Ice Sheets are part of the climate system, so it seems odd to state that they will continue to change once the climate has stabilized. Suggest to revise ln 5 to "once GMT stabilizes". [Government of Germany, Germany]	Taken into account: text changed to "radiative forcing"
26309	1	10	2	10	2	What is meant by “renewal of the large ice sheets”? Is this in a full-collapse scenario? Ice sheet mass balance changes on seasonal time scales with accumulation and ablation processes, not on millennial time scales (without forcing). [Ethan Pierce, United States of America]	Rejected. We considered adding "by the balance between accumulation and ablation" but came to the conclusion that this makes the text unnecessarily more difficult to read.
32835	1	10	2	10	2	A better reference than Buckley and Marshall (2016) is: Wunsch, C., & Heimbach, P. (2014). Bidecadal Thermal Changes in the Abyssal Ocean, 44(8), 2013,Äì2030. https://doi.org/10.1175/JPO-D-13-096.1 [Government of United States of America, United States of America]	Taken into account: We replaced the Buckley et al. reference with Matsumoto (2007) and Gebbie and Huybers (2012) see comment 4321
24933	1	10	2	10	3	What is meant by 'renewal'? Also maybe more approriate for the Greenland ice sheet? [Frank Pattyn, Belgium]	Rejected. See comment 26309
18181	1	10	5	10	5	Regarding "they will continue to evolve once climate stabilises". I suggest that this is a particularly poor choice of phrase, especially given the previous stresses on how integrated the 'climate' is. Perhaps it would be better to talk of different equilibrium timescales. [APECS Group Review, Germany]	Taken into account: We use now the term "radiative forcing" rather than climate.
26931	1	10	5	10	5	evolve' - choose better word. 'Respond' or 'change' would be better. [Liz Dovey, Australia]	Accepted
26933	1	10	5	10	5	once' - not once - better to say 'even if' or 'when' climate or atmospheric conditions stabilises/e. [Liz Dovey, Australia]	Accepted
25911	1	10	7	10	7	is 'urgent' the right term here? Don't you mean 'immediate action' (something may be urgent but may not be done) [Regine Hock, United States of America]	Accepted: We changed "urgent" to "immediate"
1903	1	10	10	10	11	perhaps the “rapid timescales” could be approximately defined, decadal or annual, monthly? (given that the previous paragraph discusses multi-centennial timescales) [Katarzyna B. Tokarska, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: There is no general timescale here. Rapid just means "much faster" than the changes prior to the reaching of the tipping point.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22435	1	10	10	10	13	Suggest including a definition of 'Tipping points'. [Government of Australia, Australia]	Taken into account: We reformulated the text to be more explict. However, we do not give a full definition of tipping point here, as this is given in the glossary.
17491	1	10	10	10	17	Additional citations and information related to the non-linear aspect as well as the potential for dangerous climate change when entering the “fat tail” of the risk. Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142; Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8; Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sciences 114(39):10315–10323. [Kristin Campbell, United States of America]	Rejected: We considered adding additional references, but then rejected it, largely because we decided to stick to the one core reference by Lenton et al. The additional references would not have added new material without a proper discussion of their content. Such a disucssion, while interesting, would go beyond the scope of this scoping chapter.
17591	1	10	10	10	17	Additional citations and information related to the non-linear aspect as well as the potential for dangerous climate change when entering the “fat tail” of the risk. Good P., et al. (2015) Nonlinear regional warming with increasing CO2 concentrations, NATURE CLIMATE CHANGE 5:138–142, 140–141 (“Nonlinearity has implications not just for the ensemble mean, but also for the spread of model projections. In general, an increased spread at higher forcing should be expected: the relative importance of nonlinear mechanisms grows with increasing forcing, so their contribution to model spread does likewise. Conceptually, this can be thought of as including an extra uncertain process at higher CO2 concentrations. This inflation in model spread at higher forcing is large when nonlinearities are uncertain, and seems to be especially relevant for change per kelvin of global warming.”); Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8, 2 (“Nonlinear mechanisms are those inconsistent with linear system theory. These may include state-dependent feedbacks, such as the sea-ice albedo feedback (which vanishes for large or zero sea-ice cover). Nonlinear mechanisms can cause climate patterns to differ at different levels of forcing. For example, if an equivalent of RCP8.5 was run with double the forcing, linear mechanisms would show exactly double the response compared with the standard RCP8.5, but nonlinear mechanisms would not. Nonlinear mechanisms have been demonstrated in a few models for very high-forcing levels, or under idealized CO2-forced experiments, for global and regional-scale precipitation, warming and ocean heat uptake. In one model study using idealized experiments, nonlinear precipitation change over tropical oceans was associated with interactions between pairs of approximately linear mechanisms (for example, simultaneous moisture increases and circulation shifts). Nonlinear behaviour of the Indian Summer Monsoon associated with the positive moisture advection feedback has also been proposed.”); Xu and Ramanathan (2017) Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, Proc. Natl. Acad. Sciences; Committee to Prevent Extreme Climate Change (2017) Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change. [Durwood Zaelke, United States of America]	Rejected: This is the same comment as 17591.

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8713	1	10	11	0		Forcing' may be unclear to the reader. It would be useful to have a brief definition in parentheses. [Nina Hunter, South Africa]	Taken into account: We rephrased the sentence to read "perturbation by some external forcing"
22191	1	10	11	10	12	"...the rapid disappearance of Arctic sea ice": This is in contrast to the statement in the Integrative Cross-Chapter Box 7 where the authors refer to sea ice retreat as one of a set of "slow onset changes" (page 3, lines 14 to 15). I suggest that the authors of Chapters 1, 3 and the Integrative Cross-Chapter Box 7 come to some agreement on terminology for this point. [Inga Smith, New Zealand]	Taken into account: This example has been taken out.
1277	1	10	12	0		Meridional overturning circulation is discussed without being described in text. The glossary entry for MOC is relatively technical as well. Perhaps a few word description should be added here. Alternatively, in this case Meridional Overturning Circulation seems to specifically refer to AMOC, so perhaps "the collapse of the Gulf Stream" or "weakening of the Gulf Stream" would be more appropriate, though that might be an American-centric phrasing. [Jacinta Clay, United States of America]	Taken into account: we replaced it with "the ocean's large-scale meridional overturning circulation in the Atlantic"
8715	1	10	12	0		Remove 'a' [Nina Hunter, South Africa]	Rejected: we could not figure out which "a" this reviewer referred to.
11179	1	10	12	10	12	The following comment of mine on the FOD has not been addressed and is still valid: „A substantial number of publications have shown that sea ice is not a tipping element (e.g., Notz, PNAS, 2009; Tietsche et al., GRL, 2011, Wagner and Eisenman, J. Clim., 2015)." Note in particular that chapter 3 of SROCC shares my view, and we will be very specific about this in AR6, too. [Dirk Notz, Germany]	Accepted: Sea-ice is no longer listed as an example.
26935	1	10	12	10	12	meridional overturning circulation' - this term hasn't been used previously in this report - needs clarification to be understood by the public. [Liz Dovey, Australia]	Taken into account: see comment 1277.
16465	1	10	13	10	13	there are very few glaciers being frozen to the ground and I wonderwhether this is an issue to be mentioned here. In turn, the irreversible changes due to the dynamics at the ice sheet margins (grounding zones) are missing in the list. [Georg Kaser, Austria]	Taken into account. This is actually what we meant to say. The text was reformulated
25913	1	10	13	10	13	what is meant by ice surge? Does this refer to 'glacier surges' in which case not sure what that has to do with tipping points? Or do you mean the ice streams for ex. In Antarctica? [Regine Hock, United States of America]	Taken into account: meant are the ice-streams. The text was reformulated.
14895	1	10	14	10	16	The process of hysteresis is not well explained here, and figure 1.1a is misleading as it gives the impression that hysteresis is the inverse of an abrupt, non-linear change. Please expand this discussion and revise the figure in order to better explain the concept of hysteresis, as we expect this to play an increasingly important role in the context of temporary overshooting and the reversal of climate change via CDR technologies. [Government of Germany, Germany]	Taken into account: Hysteresis was removed due to space constraints and also because this concept is not really used in SROCC.
30321	1	10	15	10	15	What is the antecedent to the stand-alone pronoun "This" ? If "This" refers to "hysteresis" in the preceding sentence and not all the other tipping elements mentioned in this paragraph please change "This leads to" to "This hysteresis effect leads to." [Paul Glaser, United States of America]	Taken into account: This comment is no longer applicable since the hysteresis text was removed.

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4323	1	10	17	10	17	Maybe add here a link to Chapter 6 of the SROCC. [The UBern Team Group Review, Switzerland]	Taken into account: a forward pointer was added.
22439	1	10	17	10	17	Suggest including the word 'potentially' between 'limiting' and 'dangerous'. [Government of Australia, Australia]	Rejected: This would change the meaning of the sentence.
26937	1	10	17	10	17	scientific evidence for' - 'scientific evidence supporting the case for' would be better. [Liz Dovey, Australia]	Accepted.
10989	1	10	18	10	18	would it not be more more accurate to say "changes in biodiversity,..." rather than "decreases". This comment currently encompasses all diversity, macro- and micro-, making it a very complex system. [Karen Cameron, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: no such statement exists in our text. This comments appears to apply to another chapter.
1905	1	10	19	10	21	Actually, changes in ocean warming (heat content) also have already been detected too, which is not clear from this sentence. Perhaps more studies could be cited e.g. Gleckler, P. J., Santer, B. D., Domingues, C. M., Pierce, D. W., Barnett, T. P., Church, J. A., ... Caldwell, P. M. (2012). Human-induced global ocean warming on multidecadal timescales. Nature Climate Change, 2(7), 524–529. https://doi.org/10.1038/nclimate1553 Pierce, D. W., Gleckler, P. J., Barnett, T. P., Santer, B. D., & Durack, P. J. (2012). The fingerprint of human-induced changes in the ocean's salinity and temperature fields. Geophysical Research Letters, 39(21). https://doi.org/10.1029/2012GL053389 Pierce, D. W., Barnett, T. P., AchutaRao, K. M., Gleckler, P. J., Gregory, J. M., & Washington, W. M. (2006). Anthropogenic Warming of the Oceans: Observations and Model Results. Journal of Climate, 19(10), 1873–1900. https://doi.org/10.1175/JCLI3723.1 Palmer, M. D., Good, S. A., Haines, K., Rayner, N. A., & Stott, P. A. (2009). A new perspective on warming of the global oceans. Geophysical Research Letters, 36(20). https://doi.org/10.1029/2009GL039491 [Katarzyna B. Tokarska, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: Thanks for the relevant comment. The statement was changed to include also ocean changes. However, we kept IPCC 2014 as the reference, since it includes most of the references listed here.
30323	1	10	21	10	21	Please clarify the antecedent for "this" by adding the appropriate word of words after the pronoun "this," to remove any unintended ambiguity. [Paul Glaser, United States of America]	Taken into account: The sentence was reformulated. We write now "such a formal detection" instead of "this"
32837	1	10	22	10	24	Give a couple of examples of changes in variables that are expected to become detectable in the next few decades. [Government of United States of America, United States of America]	Taken into account: We added "such as those associated with ocean acidification".
4325	1	10	25	10	25	Maybe add here reference to Frölicher et al. (2016): Sources of uncertainties in 21st century projections of potential ocean ecosystem stressors. Global Biogeochem. Cycles, 30, 1224-1243. [The UBern Team Group Review, Switzerland]	Accepted.

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32461	1	10	25	10	27	'Time of Emergence' refers to the time when anthropogenic change signals emerge from the background noise of natural variability in a reference interval (Figure 1.1b; Section 1.9.1) (Hawkins and Sutton, 2012), although, at same time, we should consider the possible trigger of changes in natural processes and natural dynamics. [Michele Capobianco, Italy]	Rejected: Although the reviewer is correct that the concept of a time of emergence does not properly take into account the adaptive capacity of organisms and ecosystems, a full dicussion of this issue is beyond the scope of this chapter. Some of these issues are discussed in box 5.1 though.
4327	1	10	26	10	26	What is a 'reference interval'?. Maybe change the word to reference period to be consistent with Figure 1.1 [The UBern Team Group Review, Switzerland]	Accepted
13731	1	10	26	10	26	Is the 'reference interval' pre-defined? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: Yes it is. Added "pre-defined" to reference period.
14897	1	10	29	10	32	Detection and Attribution, as a concept, refers to observations of past changes. It is unclear to us why the definition here is extended to include future changes, which is neither consistent with the Glossary definition, nor with the use of the terminology throughout climate and impact science (e.g. the cited references). Please delete "and future" from line 29, or provide a clear rationale with references for including future changes, and revise the Glossary entry accordingly. [Government of Germany, Germany]	Accepted: Future was deleted
3149	1	10	29	10	37	In addition to the general description of attribution and detection shown in Figure 1.1d, it may also be helpful to include a specific example that uses this approach, in order to additionally clarify this concept and highlight its importance. For example, the data from Figure SPM.6 in the Summary for the Policymakers in AR5 presents convincing, specific, quantitative support of the importance of detection and attribution. [Sloane Garelick, United States of America]	Taken into account: We used the attribution statement from AR5 about the attribution of the changes in SAT as an example.
1907	1	10	34	10	35	"contrasting scenarios" may sound confusing. Perhaps it may be good to explain it in terms of forcings, to be consistent with figure 1.1.d. e.g. single-forcing scenarios or individually-forced scenarios that allow for attribution of the forcings. Figure 1d refers to simulations with forcing of interest and without forcing of interest, so it may be good to keep it consistent. [Katarzyna B. Tokarska, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: replaced scenarios with "forcing scenarios"
530	1	10	34	10	37	Where is it discussed in the report what measures are taken to identify problems with the attirubution techniques used here? [Jenna Pearson, United States of America]	Rejected: This will be discussed at different locations within the report.
3409	1	10	36	10	37	This nuance is not reflected in the relative simplicity of Figure 1.1a [Patrick Orenstein, United States of America]	Rejected: The figure cannot show all eventualities and nuances.
34229	1	10	36	10	37	Introducing an example will be useful, on one or two variables where this is the case. [Maria Jose Sanz Sanchez, Spain]	Taken into account: At least partially. See comment 3149.
23003	1	10	37	10	37	a few more words on specificities of D&A challenges for ocean and cryosphere is very relevant (eg length of time series…) [Valerie Masson-Delmotte, France]	Taken into account: A sentence about the particular challenges was added.

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4329	1	10	39	10	39	I suggest to write marine heatwaves as a two-word term instead of the three word term thoughout chapter one. We also use the two-word term in chapter six, the glossary and it is also the consensus amongst recent emerging literature. It also helps to avoid confusion that this is not a literal wave (dynamical ocean wave) but rather an analogy to terrestrial heat waves. Please not that terrestrial heat waves are written as three-word term, but they are most likely less prone to this confusion over what is a wave than we are in the ocean field [The UBern Team Group Review, Switzerland]	Accepted.
27115	1	10	39	10	39	Please clarify the "extreme", which can be climatic extreme events, consequences extreme etc. [XIAOMING WANG, Australia]	Taken into account: "climate" was added.
290	1	10	39	10	50	This paragraph could benefit from more specific examples of extreme/compound events and cascading hazards. [Ethan Kyzivat, United States of America]	Taken into account: We added one more example. No further changes were possible given the tight space constraints.
532	1	10	39	10	50	It could be useful to state that to 'push a system to near or beyond the ends of it's normally observed range' means extreme events fall within the red tails of the pdf shown in the figure 1.1 (b), and that the outer shading of the time series is I am guessing 1 and 2 standard deviations…the red shading of the tails is greater than 2 s.d.. [Jenna Pearson, United States of America]	Taken into account: The figure captions were adjusted accordingly.
23899	1	10	39	10	50	It would be very helpful for policymakers if examples of systems affected by extreme events and cascading hazards are included in this subsection and the executive summary for Chapter 1. [Government of Japan, Japan]	Taken into account: An example has been added.
288	1	10	40	10	41	Can you provide an example in $$ and citation for how costly extremes can be? [Ethan Kyzivat, United States of America]	Rejected: This goes beyond the scope of such a framing chapter.
5573	1	10	40	10	41	Extremes also cause widespread cascading impacts that affect social systems. Loss of life is not the only social impact of extremes that affect human systems. In addition our institutions and governance arrangements are stressed , sometimes to breaking point. Please make this sentence more inclusive of the losses felt from extremes. There is much literature to support this well-known to the Lead authors of this Report. [Judy Lawrence, New Zealand]	Taken into account: Added "including it socio-economic aspects"
1881	1	10	44	10	44	the definition of compound events as the co-occurrence of more than one extreme event is too narrow. A compound event can also occur from the co-occurence of events or trends (i.e. hazards) that are in itsself not extreme but in their combination causing a rare event with severe impact, e.g. sea level rise in combination with a storm surge. See also Zscheischler et al. 2018 https://doi.org/10.1038/s41558-018-0156-3 or BOX 4 in ch1. [Jana Sillmann, Norway]	Taken into account: we now state the joint probabilities have to be rare.
282	1	10	45	10	46	Could you provide a better example of co-ocurring extreme events directly impacting human systems (e.g. heat wave, drought and fire ocurring at once)? The current example of marine heat waves may not seem as important. [Ethan Kyzivat, United States of America]	Rejected: the length of the text is very limited. Thus we restricted ourselves to the listing of one example.

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3151	1	10	46	10	49	The concept of "feedback", as presented in Figure 1.1c, is important to understanding changes in a coupled system. However, in this text description that refers to Figure 1.1c, the terminology differs from that used in the figure and the caption (e.g., the text refers to "compound events", which aren't mentioned in the figure, and the text doesn't refer to "feedbacks"). Using the same terminology may help clarify this concept and emphasize its importance. [Sloane Garelick, United States of America]	Taken into account: The concept of feedbacks has benn added to the figure caption. We considered adding a panel illustrating the concept of compound events, but refrained from this given the complexity of the issue and the tight limitations in space imposed upon us. Chapter 6 and the cross-chapter box on risks dives deeper into these issues.
1883	1	10	47	10	47	What are cascading hazards? Should be cascading effects as in Fig. 1.1. [Jana Sillmann, Norway]	Taken into account: changed hazards to effects
8717	1	10	49	0		Comma after 'bring' should be removed [Nina Hunter, South Africa]	Accepted
30493	1	11	0	11	13	I suggest swapping c and d in the figure, as in the text above detection and attribution (currently d) is discussed before cascading effects (currently c). [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: We added two new subpanels and then indeed switched the sequence.
5575	1	11	0	11		Fig 1.1 c) Cascading effects shows a feedback from impacts to human systems to forcing. Some adaptations can also create feedback to forcing by increasing the GHG emissions. It would be helpful for policy makers to have adaptation included in this Figure to communicate that adaptation and mitigation are intimately linked. [Judy Lawrence, New Zealand]	Taken into account: adaptation was added to the figure.
1281	1	11	1	0		For part a) I think the figure requires a understanding of non-linear systems to grasp. Similarly I think b, c, and d are all more confusing than just using a real example. To explain the idea of hysteresis / non-linear forcings, I would suggest showing a cartoon of a system with hysteresis (for example, a glacier melting) instead. In the first frame, I would depict a stable glacier, melting at the base and snowing at the top. In the second frame, I would depict that same glacier melting as the temperature has increased. Then the temperature decreases to normal again, but the glacier continues to melt because its easier to melt at lower altitude. Just an idea. [Jacinta Clay, United States of America]	Rejected: We considered to show indeed a real world example, but in the end decided to stay with an abstract example. We believe that this conveys the concepts better.
1283	1	11	1	0		For part b), I would suggest simplifying this for many reasons: 1) a probability distribution function is likely less intuitive than just using the words upper or lower extremes, 2) seeing an real example of how envelops work is probably more educational than this theoretical example. A real temperature example with well-marked components would be better, but the section would be fine without this figure at all. [Jacinta Clay, United States of America]	Rejected: see answer to comment 1281 above.
1285	1	11	1	0		For part c), this figure is innapropriately simple and does not indicate that human activities impact the climate forcing besides mitigating it which is a major antithesis to this report. An example of one or several feedback systems (the ice albedo would be especially relevant here) would be more informative [Jacinta Clay, United States of America]	Taken into account: We modified this panel somewhat to take this concern into account (see also response to comment 5575). Specifically, we added adaptation.
1287	1	11	1	0		For part d), this figure is also more confusing than necessary and a real example would likely be more helpful. [Jacinta Clay, United States of America]	Rejected: see answer to comment 1281 above.

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14901	1	11	1	0		Fig.1.1a The concept of hysteresis is not well depicted here, it suggests a close connection between processes that exhibit non-linear, abrupt change and hysteresis, whereas, to our knowledge, hysteresis can also happen with slow-onset effects, or in fact temperature itself. Please revise the graph to clarify, and amend language in p 10 lns 14-16. [Government of Germany, Germany]	Rejected: no longer applicable since we removed hysteresis.
14903	1	11	1	0		Fig 1.1c: the arrow from human systems changes to forcing should not be labelled "mitigation", as this would suggest that mitigation is the only influence on forcing, and that all changes in human systems automatically lead to mitigation, whereas of course the change could also be an increase in forcing caused by human activity. Please revise, e.g. by not labelling the arrow at all, or include a more complete set such as "anthropogenic GHG emissions, land use change etc." or maybe "reduction/increase in anthropogenic forcing" [Government of Germany, Germany]	Taken into account: the arrow is now labeled "human action"
31557	1	11	1	0		Figure 1.1. The term "forcing" is transversal for all panels. At the moment, it´s definition is provided in Panel B. I suggest that Panel B is moved to the first panel. [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: Yes, forcing is to a certain degree transversal. But that is also why it is shown in panel A. Moving current panel B to A would thus downplay the role of forcing.
31559	1	11	1	0		Figure 1.1. Panels B and D could be merged into a single one. [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: We considered this, but the two panels demonstrate two very different concepts, even they look somewhat similar at first sight. Thus, a merger is impossible. The only possibility is to remove a panel. A possibility we rejected.
31561	1	11	1	0		Figure 1.1. In Panel C, the word "forcing" within the box may be accompanied by the example given in the caption "(eg. greenhouse gasses)". [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: the arrow is now labeled "human action (e.g. greenhouse gas emissions)"
1289	1	11	1	0	13	It is not intuitive that the lowest 1st and highest 99nth percentile are those colored on the PDF unless one has already taught or taken statistics recently [Jacinta Clay, United States of America]	Rejected: We left the "extremes" colored. We consider that also a person not trained in statistics would grasp the concept of an extreme being an event at the tail of a distribution.
68	1	11	1	11	1	Figure 1.1: Redundancy between b) and d) is confusing--should make coloring of variability envelope transparent/dashed so that it is not confused with simulaitons without forcing of interest, which also might be shown to vary somewhat moreso in time after emergence. [Baylor Fox-Kemper, United States of America]	Taken into account: We changed the colors between the two panels.
70	1	11	1	11	1	Fig. 1.1: Arrows going between boxes are hard to figure out where they start and end. Resizing the biological & ecological changes box so the arrow from physical/biological to human changes can go without interruption would be better. Feedback arrows also need to be within boxes, as it is possible to have feedbacks that do not cut across the domains. [Baylor Fox-Kemper, United States of America]	Taken into account: These are good suggestions, but resizing the boxes would not have solved the problem. In fact, it would have made it worse. We also considered adding additional feedback arrows, but this would have made the figure overly busy. We decided to solve this problem by adding a grey line across the green box to connect the two pieces of the arrow
72	1	11	1	11	1	Fig 1.1. a). This figure is schematizing complex ideas in an abstract way, which is likely to confuse more than illuminate. Starting instead from specific concrete examples of forcing & response and then showing the abstract generalization of all such figures is better pedagogy. Indeed, b & d also suffer from this problem. The classic AR5 warming by continent with and without AGW forcing is better as it is not abstract. Perhaps an adaptation of that for SROCC can be made instead? [Baylor Fox-Kemper, United States of America]	Rejected: See also comment 1281. We considered this option, but decided to stay with an abstract example to emphasize the concepts

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286	1	11	1	11	1	Figure 1.1: To avoid having arrows intersect or "pass behind" the green box in part c), you could move it down and have the arrow pass "around" it from above. OR- you could replace this figure with a version of figure 1.1 a) with forcing on the x axis and response on the y axis. This would demonstrate what you mean by "nonlinear response." [Ethan Kyzivat, United States of America]	Taken into account: We added a grey line.
672	1	11	1	11	1	I think the blue line in panel (d) should also show some evolution unlike staying relatively constant, so that people can clearly see the difference between panels (b) and (d). In addition, panel (c) can be organized in a different shape so the bidirectional links between each pair of components look better. [Mengxi Wu, United States of America]	Rejected: It is the very idea of the blue band in d to stay relatively constant. W
1595	1	11	1	11	1	Figure 1.1 condense this figure into 2 panels if possible. There is currently too much information and it is difficult to read. In addition, panel c) should be made vertical to make it easier to read. [Nora Richter, United States of America]	Rejected. Condensing the figure into fewer panels is only possible by showing fewer concepts. We decided against this option. Instead, we substantially expanded the figure caption with the hope that this would improve the readability
3443	1	11	1	11	1	In square A, what is the significance of the break in the time axis? There is no time scale given, so it is confusing for there to also be a gap in it. [Patrick Orenstein, United States of America]	Rejected: This feature was removed.
11367	1	11	1	11	1	Figure 1.1c), This sub-figure doesn't really represent a "true" coupled system and is misleading. Specifically, feedback can jump between subsystems (e.g. Feedback can exist between human system changes and physical biogeochemical changes without the intermediate biological ecological changes). In addition, human systems changes also affects forcing and is missing in the figure (e.g. human burns fossil fuel, which releases greenhouse gases to the atmosphere) [Anson Cheung, United States of America]	Taken into account: This panel was augmented with elements of this comment.
11369	1	11	1	11	1	Figure 1.1b and d. It is a bit confusing to label y-axis as system state, which is a term more distant to climate than other names such as climate variable of interest. [Anson Cheung, United States of America]	Taken into account. We relabeled the two y-axis now with "climate variable". This makes it also consistent with the x-axis label for panel f.
14899	1	11	1	11	1	Fig. 1.1a seems to be of poor quality. Please check if fonts could be increased and line width could be increased [Government of Germany, Germany]	Taken into account. The line with was increased.
26939	1	11	1	11	1	Fig 1.1 B. Variability diagram - the label 'extremes' is not clear in what it is referring to - it does not point to the two coloured in extremes of the distribution. [Liz Dovey, Australia]	Taken into account. The red and blue areas were now connected with the label "extremes".
26941	1	11	1	11	1	B.Variability diagram - doesn't depict the changing frequency aspect ie. the reducing incidence/recurrence interval between extreme events. (This can be more important than the intensity of the event, even if it is outside previous range). [Liz Dovey, Australia]	Rejected: This is indeed potentially important, but we considered this to be outside of the purview of our framing chapter.

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26943	1	11	1	11	1	B. Variability diagram - 'Emergence' - I know it is explained in the fig text but still don't think this is the best word to use in this context - emergence from variability period of reference period sounds more like a caterpillar emerging. Wrong 'feel' and isn't used in the same adjectival way as in other places. Isn't there a better possible term relating to the concept of exceeding previous boundaries? Also possibly confusing with the wider use of terminology "emergent risks", more appropriately being used in the risk assessment context. [Liz Dovey, Australia]	Rejected: The terminology might not be perfect, but the term has by now become a common one. In fact, it has now its own box in chapter 5.
26945	1	11	1	11	1	C. If possible, the Cascading figure would be much more effective rotated 90 degrees to depict a vertical cascade. Given it is much blockier than the three other parts of the figure, would think this could be possible. [Liz Dovey, Australia]	Rejected: We considered this. But decided against this - mainly because a vertical arrangement would have implied a hierarchical structure.
534	1	11	1	11	13	For (a) Label 'abrupt, non-linear' instead of 'non-linear, abrupt' to be in keeping with the linear labeling. What are examples of the delayed response? I couldn't isolate any in the text. Is no response needed on this figure? (b) The occurrence of extreme events on either side of the time of emergence could be shown, if the goal is to suggest more frequent extreme events under climate change. (c) The figure could be arranged such that the green box is shorter, and the arrow that goes underneath it moved to clean things up. (d) If the goal of (c) is to provide an example of a generic dynamical system, perhaps you could extend the terminology to this figure as well for a concrete example. [Jenna Pearson, United States of America]	Partly taken into account, partly rejected. We clarified that the arrow going underneath the green box is a connected one.
1909	1	11	1	11	13	Figure 1.1. Panel b. caption: it is not clear what the difference between the two shades of red is -different confidence intervals. Figure 1.1 Panel b. Maybe the red shaded areas could be labelled as the 'anthropogenic forcing envelope'. Figure 1.1. Panel d. Perhaps panel 1d could be labelled 'All forcings including forcing of interest'? (since often the all -forcing response is regressed onto observations). [Katarzyna B. Tokarska, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the two areas of red are now labelled.
13733	1	11	1	11	13	Figure 1.1: Not sure this figures adds anything on top of the what is included in the text. It could be deleted to save space. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected: Figures are an important means to transport information. Yet even though one might have the impression that this figure does not add new information beyond what is given in the text, we are convinced that this figure will reach a far wider community that the text ever would. We thus decided to keep the figure.
13735	1	11	1	11	13	Figure 1.1 - The red line in part (a) of the figure is unclear, what is this showing? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected: It is the forcing. But this is already labeled.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22437	1	11	1	11	13	Suggest a more clear explation of Panels (a) and (c). In Panel (a) the key point of this figure is unclear, and even if this is used the lower graph of (a) needs to have the tipping point extended to the delayed curve. In Panel (c) this plot is difficult to follow, particularly as mitigation only comes from human systems to forcing - which too simplistic. [Government of Australia, Australia]	Taken into account: The caption has been substantially expanded. Also panel c has been modified to include a broader definition of processes affecting radiative forcing.
27257	1	11	1	11	13	Figure 1.1-Too mauch information i o ne figure- Suggestion- Separate Figura 1.1 A from the others. [Gleyci Moser, Brazil]	Rejected. See also response to comment 13733.
29021	1	11	1	11	13	For purposes of threshold behavior and non-linear response, it would be helpful to show the response in 1.a continuing well past the period of forcing. For example, for ocean and cryosphere dynamics including acidification and ice sheet loss, the dynamic once triggered will continue for many hundreds or thousands (especially acidification) of years beyond when the forcing resturns to previous levels. This figure currently does not reflect this important dynamic. [Pam Pearson, Sweden]	Taken into account. In fact, we added an entirely new panel showing this concept.
32839	1	11	1	11	13	Panel C needs to show that realm of human forcing is not just "mititgation". It is also the "emissions" and land use change that cause climate change (as described in Section 1.4). [Government of United States of America, United States of America]	Taken into account. Panel c was expanded to take this comment into consideration.
26311	1	11	3	11	5	The description of hysteresis does not match the figure provided. [Ethan Pierce, United States of America]	Taken into account: hysteresis has been removed.
4331	1	11	6	11	6	Natural variability can be forced (e.g. volcanoes, solar, etc) and unforced (internal). [The UBern Team Group Review, Switzerland]	Taken into account: This is what is written.
26947	1	11	10	11	12	Is there a point to mentioning s1.9.3? Are there unlikely occurrence/ high impact forcings relevant to this report mentioned in the AR5? Left hanging wondering. [Liz Dovey, Australia]	Rejected: it remained unclear to us how to respond to this suggestive comment
23005	1	11	11	11	11	In caption of Figure 1.1, D&A is suggested to be just a statistical framework, which is not correct as attribution also considers physical understanding. [Valerie Masson-Delmotte, France]	Taken into account: text adjusted
32841	1	11	16	13	25	Section 1.4 on observed changes in the oceans and cryoshpere is very well written, but it is just an abstract and not inclusive of what one would expect in a section with this title. Suggest changing the section title to "Summary of …" -- pointing the reader to subsequent chapters for more detail. [Government of United States of America, United States of America]	Rejected: We did not consider the current title as misleading.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1291	1	11	18	0	21	" This includes the seasonal waxing and waning of sea-ice, interannual to decadal ocean temperature changes of the El Niño-Southern Oscillation (ENSO) phenomenon that disrupt global rainfall patterns (Trenberth et al., 2002; Timmermann et al., 2018), and major shifts in ocean circulation, chemistry, and sea level associated with ice age cycles of the last million years and beyond" is unnecessarily wordy. "This includes the seasonal melt and formation of sea ice****citations****, interannual variation of ocean temperature caused by El Ni~no Southern Oscillation (ENSO) ****citations***** and milleniel ice ages ***citations****." should be sufficient for the framing + context section. Also why are there citations for El Nino and ice ages but not sea ice? [Jacinta Clay, United States of America]	Taken into account. Sentence was shortened and a reference was added for sea-ice
18183	1	11	18	11	18	I suggest that 'growth and melting' or 'advance and retreat' would be much better for readers. [APECS Group Review, Germany]	Taken into account. Growth and melting is now being used.
11371	1	11	18	11	26	It is confusing to associate changes of particular variables (e.g. sea level, ocean temperature) to a specific timescale, when in fact all the variables mentioned can change on all the time scales mentioned. This can mislead reader to think that those variables only change on a particular timescale (e.g. sea level only varies on orbital timescales). [Anson Cheung, United States of America]	Rejected: These examples are illustrative and not exhaustive.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29595	1	11	18	11	26	I think the phrasing of this particular paragraph needs to be changed. One of the criticisms by the climate denier/skeptic community is that the climate has always been changing and that changing is natural. This perspective is reinforced in this paragraph by saying the that the climate has "varied" over a lot of scales. Use of the word "varies" tends to imply that at least some of these changes are just random fluctuations, and so the present could well be just a typical fluctuation. When people make suggest to me that the climate has always varied or changed, my answer is not to first talk about the uniqueness of the present human-driven situation, but to instead say that the past climate has changed is exactly why human-induced change should be of concern. I say this because what Earth's history suggests is that virtually all of the different climates in the past were caused, or driven by specific factors--the part of global climate change that is due to random internal fluctuations appears to be pretty small (perhaps no more than plus or minus half a degree or so over, say, a decade or two period, and less over longer times). For all longer term and larger differences over time, they are arguably mainly caused by some forcing, either natural or, very recently, human-driven (some, like changes in land cover, not yet fully understood). So, Earth history really teaches us that climate does not really just vary, and I would strongly urge not using the words like "vary", "varies", etc. that imply changes just happen, and are not forced. The lesson I think is thus that climate responds to forcings, and that human forcings over recent decades are as large and moving toward exceeding natural forcings that have caused/led to significant differences in the global climate in the past. So, I think the phrasing here is very important, and, as suggested in an earlier comment, I think the chapter needs a box that explains the lessons we have learned from Earth's climate history, and we, as scientists, need to be very careful in how we explain this. So, in particular, separate out the random part (e.g., ENSO, PDO, etc.) from the forced part (volcanic eruptions, and so on) and don't call them both variations--that just really has the potential to be misused by skeptics/deniers and to confuse the public when talking about forced changes (even some that are not yet fully explained). [Just a note that I do agree that natural variations on the regional scale can be larger than on the global level, so the discussion above was about changes in the global average temperature.] [Michael MacCracken, United States of America]	Rejected: We thank the reviewer for his exhaustive comment. We discussed this within the author team and came to the conclusion that the expression "vary" is appropriate here.
304	1	11	21	11	22	What are the timescales of glacial/interglacial cycles? You have given them for the other climate variability drivers. Giving a number (e.g. 50-100 thousand years) would provide context for future statements that note the last time in Earth's history that a certain event occurred. [Ethan Kyzivat, United States of America]	Taken into consideration: "tens to hundreds of thousands of years" was added.
18167	1	11	22	11	23	With six citations here, something could probably be cut. The Clark and Shakun papers are more focused on the LGM, whereas the others are more focused on multiple cycles. The latter group seems most relevant to the statement being supported. [APECS Group Review, Germany]	Taken into account: We cut two of the 6 references.
11811	1	11	25	11	26	Add the variability that the Pacific Decadal Oscillation also contributes. [William Lorenz, Australia]	Rejected: The examples are indicative and not mean to be exhaustive.
1293	1	11	26	0		To remain phrasing similarity with the other two examples "changes in Earth's orbit around the sun" is more appropriate than "Earth's orbit around the sun" [Jacinta Clay, United States of America]	Accepted

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28317	1	11	28	11	29	The first sentence is rather "off-putting" and I would simplify the end of it, for example just "human activities have been acting on Earth's climate". The next sentence is bringing all necessary light on this. [Anne GUILLAUME, France]	Taken into consideration: The sentence was reformulated.
13737	1	11	28	12	4	This paragraph is too general/not specific to oceans and cryosphere. Either shorten it to key points and/or make it specific to oceans and cryosphere, e.g. impact of aerosol (BC) on ice/snow. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into consideration. The whole paragraph has been revised.
5239	1	11	31	11	32	I suggest to put the following idea in the text: "and most importantly the accumulation of greenhouse gases (including CO2; Section 1.8.1) in the atmosphere as a result of the burning of fossil fuels, cement production, and land use change, and others" - because agricultural activities, industrial activities and waste contribute to GHG emissions. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into consideration. We added "agriculture" to the list. See also comment 11813.
11813	1	11	32	11	32	Should add agriculture also contributes substatially to GHG emissions. [William Lorenz, Australia]	Accepted.
2401	1	11	32	11	33	You write: "In 2016, the global average atmospheric CO2 concentration crossed 400 parts per million, a level not known for millions of years (Fischer et al., 2018)." While this is true, it would be more transparent to also state that the atmospheric CO2 level in fact exceeded 400 ppm during the vast majority (probably more than 90%) of Phanerozoic Earth history. Otherwise readers may get a fully distorted view of geological CO2 development. [Sebastian Luening, Portugal]	Rejected. The focus of our analysis is the more recent past of Earth, and not the deep past.
18345	1	11	32	11	33	In this sentence "……a level not known for millions of years", Can we clearly mention whether we are talking for "Past" or "Future" [APECS Group Review, Germany]	Taken into consideration: Added "past"
298	1	11	32	11	34	Can you express a confidcne measure on the millions of years statement? [Ethan Kyzivat, United States of America]	Taken into consideration: added "very likely"
18185	1	11	33	11	33	The phrase 'not known' is inappropriate. I suggest 'experienced' woud be an improvement. [APECS Group Review, Germany]	Taken into consideration: rephrased sentence and used "experienced".
32843	1	11	33	11	33	Change "a level not known for millions of years" to "a level not realized for millions of years". [Government of United States of America, United States of America]	Taken into consideration. See comment 18185.
34231	1	11	33	11	33	Should not said, an average atmospheric level never observed before? [Maria Jose Sanz Sanchez, Spain]	Taken into consideration. See comment 18185.
23007	1	12	0	13		Section 1.4 is repeating the AR5, how is this integrated with the rest of the report? And there is nothing on projections as reported in the AR5. It could be more interesting to map what aspects of AR5 (observations and projections) have been updated and complemented here than repeating the AR5 findings. [Valerie Masson-Delmotte, France]	Taken into account. The scope and ambition of this section was thoroughly discussed within the chapter team as well as with the co-chairs. We do feel that we have to give a brief summary of the main findings of AR5 (and SR1.5) as the point of departure, but this was shortened to the minimum. A new cross chapter box on projections was added.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2403	1	12	1	12	2	You write: "Earth's widespread, rapid and accelerating climate warming since 1850 is exceptional compared with natural changes in palaeoclimate records…". This not true, especially not in a Holocene context. Earth has seen various periods in the last 10,000 years during which present-day temperatures were reached or exceeded (e.g. some phases of the Holocene Thermal Maximum, HTM). Likewise, rates of temperature change have been similar or have been exceeded during various episodes of the Holocene as evidenced by multiple palaeoclimatological studies. A good reference is Kemp et al. 2015 (doi: 10.1038/ncomms9890). Those authors conclude: "Our findings indicate that the true attainable pace of climate change on timescales of greatest societal relevance is underestimated in geological archives." In their press release about the paper, the authors specify: "Researchers at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) have shown in the latest edition of the journal Nature Communications* that the temperature changes millions of years ago probably happened no more slowly than they are happening today." https://www.fau.eu/2015/11/10/news/research/idea-of-slow-climate-change-in-the-earths-past-misleading/ [Sebastian Luening, Portugal]	Rejected: This paragraph has been revised extensively as we wanted to make it more specifc about the ocean and cryosphere. We thus deleted this statement. Not because we no longer consider it to be correct, but because we no longer considered it to be so crucial in the more specific context of the ocean and cryosphere.
11373	1	12	2	12	2	PAGES2k, 2017 Scientific Data is another reference that can be added) [Anson Cheung, United States of America]	Rejected. This statement has been deleted.
16467	1	12	2	12	4	This statement is superfluouse at this point. [Georg Kaser, Austria]	Taken into consideration. The whole paragraph has been revised.
11375	1	12	6	12	12	This paragraph doesn't bring any information about changes in the ocean and cryosphere. Additionally, it does not help the discussion about changes in the subsequent subsections because there was no discussion on low likelihood high impact events and how estimates of these events have changed in SROCC in this section. [Anson Cheung, United States of America]	Taken into account: The whole paragraph has been rewritten to bring the ocean and cryosphere into the center of attention..
17493	1	12	6	12	12	Should specific IPCC 1.5C Special Report conclusions pertaining to the Polar Regions be added into this? Possible sections from the 1.5C Report to include: §3.3.8 for sea ice and §3.3.9 for sea level. [Kristin Campbell, United States of America]	Rejected: Taken into consideration. The whole paragraph has been revised.
17593	1	12	6	12	12	Include some of the specific IPCC 1.5C Special Report conclusions pertaining to the Polar Regions be added into this? Possible sections from the 1.5C Report to include: §3.3.8 for sea ice and §3.3.9 for sea level. [Durwood Zaelke, United States of America]	Rejected: Taken into consideration. The whole paragraph has been revised. See comment 17493
18159	1	12	7	12	9	I don't think it's clear what "err on the side of caution" means here. Looking at the cited article, it means under-predicting the magnitude of climatic changes. Without that context, though, it could easily be interpreted as the opposite -- as alarmism. [APECS Group Review, Germany]	Taken into account: the expression has been rephrased. Now used under rather than overpredict
28319	1	12	8	12	9	add "likeliness" to read "and in some caces their likeliness underscored by excess of caution". I am not too fond of the "err on the side of caution". [Anne GUILLAUME, France]	Taken into account: The expression has been rephrased. See comment 18159.
300	1	12	10	12	12	Is the SROCC also attemtping to" report on potential changes for which there is low scientific confidence…but that would have large impacts if realised?" [Ethan Kyzivat, United States of America]	Taken into account: Yes, SROCC does report on this low likelyhood/high impact processes. No explicit mentioning is required here, though.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
3157	1	12	14	12	14	It might be helpful to include some sort of summary figure or table that presents the major findings described in Section 1.4.1 and Section 1.4.2. [Sloane Garelick, United States of America]	Taken into account (partially) - we have added Table SM1.1 in the Supplementary Material section summarizing the findings from previous IPCC reports. However, in Sections 1.4.1 and 1.4.2 the points of departure and confidence language are from the IPCC reports AR5 and SR1.5.
16659	1	12	14	12	41	This would be a useful paragraph if it would focus on distilling AR5 results in terms of Ocean. Unfortunately, it goes beynd and produces a mini-assessment that is detrimental to SROCC, especially from line 22 to line 25, which seems to summarize SROCC Chapter 5 content instead of providing framing from prior knowledge and foundation for refined results - lines 31 to 33 are making a better job here at preparing the reader to what can be expected, without giving the results, which is the purpose of the SPM or Chapter 5, but not Chapter 1. [Samuel Morin, France]	Taken into account - Paragraph has been revised. Mini assessments from other chapters have been deleted and we now refer to the specific sections in SROCC.
18195	1	12	16	12	16	In addition to bulk warming, the observed patterns of warming have an very substantial impact on climate through alteration of gradients for example. I suggest that at least some mention of spatial variation in trends is given some mention here. See for example, Xie et al., 2010: Global warming pattern formation: Sea surface temperature and rainfall. Journal of Climate. 23. 966-986. This of course includes ENSO. [APECS Group Review, Germany]	Taken into account - Thank you for this comment. However, Chapter 1 is framing. This should be covered in Chapter 5 and the comment has been passed to Chapter 5 for consideration.
26313	1	12	16	12	17	It may be worth including regional differences in absorbed “extra” thermal energy (i.e. the Southern Ocean has absorbed a disproportionate amount). [Ethan Pierce, United States of America]	Taken into account - Thank you for this comment. Chapter 1 is framing and this should be covered in Chapter 3. This comment has been passed to Chapter 3 for consideration.
22441	1	12	17	12	17	Suggest replacing 'greenhouse gas buildup' with 'increases in greenhouse gas concentrations'. [Government of Australia, Australia]	Accepted
24643	1	12	20	12	20	definition of the upper ocean is different to that previously stated in this chapter. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account - The full chapter has been revised for consistency.
34233	1	12	22	12	23	Can the authors elaborate more on what they label as extrem events in this case, what a ocean heat wave is? [Maria Jose Sanz Sanchez, Spain]	Noted - Extremes and Ocean Marine Heat Waves are defined in the Glossary.
1597	1	12	23	12	23	"Marine heat waves" are never defined. What are they? Please clarify. [Nora Richter, United States of America]	Noted - Extremes and Ocean Marine Heat Waves are defined in the Glossary.
1599	1	12	23	12	25	Clarify what is meant by "an acceleartion fo the Earth's water cycle" and how that relates to changes in sea surface salinity. [Nora Richter, United States of America]	Taken into account - The text has been revised. We use the word "altered" to refer to regional changes in the water cycle. However, Chapter 1 is aiming to give a framing, and the link to corresponding chapters/sections is added where this topic is assessed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
3153	1	12	23	12	25	What are the sources for the "high confidence" level that Earth's water cycle has accelerated? [Sloane Garelick, United States of America]	Noted - The source is the IPCC AR5 report. We have added the reference to make that clear. We have also revised the text and we use the word "altered" to refer to regional changes in the water cycle.
11611	1	12	24	12	25	What are the consequences of an acceleration of the Earth's water cycle? [Government of Mexico, Mexico]	Taken into account -Thank you for the comment. However, Chapter 1 is aiming to give a framing, and the link to corresponding chapters/sections is added where this topic is assessed.
34235	1	12	24	12	25	What is meant by "water cycle acceleration"? [Maria Jose Sanz Sanchez, Spain]	Taken into account - The text has been revised. We use the word "altered" to refer to regional changes in the water cycle.
4963	1	12	27	12	28	It might be helpful to quantify how much it has risen. [Debra Roberts and Durban Team, South Africa]	Accepted - We added the statement from AR5: "Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to 0.21] m"
17495	1	12	27	12	33	Ice sheets add to the uncertainty and possible for many meters of SLR. Also, concerns about SLR should extend beyond 2100 because SLR will continue to occur even after warming has slowed. Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8; and Solomon S., et al. (2009) Irreversible climate change due to carbon dioxide emissions, PROC. NATL. ACAD. SCI. USA 106(6):1704-1709, 1707. [Kristin Campbell, United States of America]	Accepted. This paragraph has been rewritten.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17595	1	12	27	12	33	Ice sheets add to the uncertainty and possibility for many meters of SLR. Also, concerns about SLR should extend beyond 2100 because SLR will continue to occur even after warming has slowed. Good P., et al. (2016) Large differences in regional precipitation change between a first and second 2 K of global warming, NATURE COMMUNICATIONS 7(13667):1–8, 2 ("Nonlinear mechanisms are those inconsistent with linear system theory. These may include state-dependent feedbacks, such as the sea-ice albedo feedback (which vanishes for large or zero sea-ice cover). Nonlinear mechanisms can cause climate patterns to differ at different levels of forcing. For example, if an equivalent of RCP8.5 was run with double the forcing, linear mechanisms would show exactly double the response compared with the standard RCP8.5, but nonlinear mechanisms would not. Nonlinear mechanisms have been demonstrated in a few models for very high-forcing levels, or under idealized CO2-forced experiments, for global and regional-scale precipitation, warming and ocean heat uptake. In one model study using idealized experiments, nonlinear precipitation change over tropical oceans was associated with interactions between pairs of approximately linear mechanisms (for example, simultaneous moisture increases and circulation shifts). Nonlinear behaviour of the Indian Summer Monsoon associated with the positive moisture advection feedback has also been proposed."); and Solomon S., et al. (2009) Irreversible climate change due to carbon dioxide emissions, PROC. NATL. ACAD. SCI. USA 106(6):1704-1709, 1707, 1708 ("Anthropogenic carbon dioxide will cause irrevocable sea level rise.... An assessed range of models suggests that the eventual contribution to sea level rise from thermal expansion of the ocean is expected to be 0.2–0.6 m per degree of global warming (5). Fig. 4 uses this range together with a best estimate for climate sensitivity of 3 °C (5) to estimate lower limits to eventual sea level rise due to thermal expansion alone. Fig. 4 shows that even with zero emissions after reaching a peak concentration, irreversible global average sea level rise of at least 0.4–1.0 m is expected if 21st century CO2 concentrations exceed 600 ppmv and as much as 1.9 m for a peak CO2 concentration exceeding 1,000 ppmv."). [Durwood Zaelke, United States of America]	Accepted. This paragraph has been rewritten.
18193	1	12	27	12	33	It would be worth including that recent work has shown that ocean surface waves are a very important and substantially under-estimated contributor to changes in coastal sea-level rise. (Melet et al., 2018: Under-estimated wave contribution to coastal sea-level rise. Nature Climate Change. 8. 234-239). [APECS Group Review, Germany]	Taken into account - Chapter 1 is framing and this can not be covered here, the comment has been passed to Chapter 4 for their consideration.
24329	1	12	27	12	33	More details could be provided here. By how much has the large uncertainy range been reduced. [Philippus Wester, Netherlands]	Noted - This discussion has been corrected, as the uncertainty of sea level projection assessed in Chapter 4 is larger than AR5 especially for high-emission scenarios. We cross-link the new text to the specified section in Chapter 4

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11613	1	12	31	12	32	What is the differences between uncertainty range to AR5 and SROCC? [Government of Mexico, Mexico]	Noted - According to Chapter 4, the uncertainty of sea level projection is larger than AR5 especially for high-emission scenarios. We cross-link the new text to the specified section in Chapter 4, as Chapter 1 is framing and the assessments are done in te other chapters.
29597	1	12	31	12	32	I have yet to read the chapter justifying this statement, but from reading the SPM and its projection of expected SL rise out to 2100, it is not obvious that how much SL rise could occur this century has really been considered--it certainly seems to me that the uncertainty range for 21st century SL rise needs to be considerably larger than shown in the figure included in the SPM. I would again note that from 20 ka to 8 ka, sea level rose at an average rate of 1 m/century for 120 centuries when the global average temperature was rising at a rate of 1 C per 2000 years. We are now in a period where the global average temperature is rising at a rate that is of order 40X the past rate (!!) and it is pretty clear that the equilibrium sea level sensitivity must be something like 15-20 meters per degree C in global average temperature. I will be interested to see if the later analysis provides a perspective accounting for lessons on sea level rise provided by Earth's climatic and sea level history--without this, an assertion that the uncertainties regarding projections for sea level rise have been reduced; I simply don't understand how this statement can be justified given the potential for relatively rapid collapse of some ice streams due to the basal bathymetry and the calculations presented in the papers by Pollard and DiConto , whose model seems to have improved simulation of Antarctic's time history of ice sheet mass and suggests that the calving and breakdown of ice shelves has been underestimated. [Michael MacCracken, United States of America]	Accepted - This statement has been corrected and the discussion has been rewritten.
30495	1	12	31	12	32	“SROCC reduces” sounds weird; not SROCC reduces, but the new literature since AR5 (which is assessed in SROCC) allows for statements with higher certainty. Suggest rephrasing. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - The sentence has been rewritten.
1295	1	12	35	0	37	Does this first sentence of this paragraph need citations? Also pH and acidity are described as if they are separate things, which feels innapropriate [Jacinta Clay, United States of America]	Accepted - This sentence has been revised.
294	1	12	35	12	41	Could you add a sentence on why these biogechemical changes are good or bad for the ocean? Could you define pH and explain how it differs from acidity? [Ethan Kyzivat, United States of America]	Noted - A reference to the AR5 Cross-Chapter box has been added. pH and acidity are defined in the glossary.
1601	1	12	36	12	37	This seems redundant: "In response, ocean acidity increased by 26%, ocean pH decreased by 0.1" [Nora Richter, United States of America]	Noted - The sentence has been revised for clarity. It seems important for non-expert to provide both the change in pH and in the concentration of H+.
8719	1	12	36	12	37	Ocean acidity increased by 26% but confidence level is not stated in parentheses [Nina Hunter, South Africa]	Noted - That is because the level of confidence is the same as the one for pH. Sentence revised for clarity

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5241	1	12	36	12	38	In the following text in the text: "In response, ocean acidity increased by 26%, ocean pH decreased by 0.1 (high confidence), and oxygen concentrations decreased in many ocean regions (medium confidence) " - if it is possible need values in the oxigen concentrations because show more clear the negative effects. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Noted - The sentence about deoxygenation has been revised. Chapter 1 is framing, this topic is being assessed in Chapter 5.
11615	1	12	36	12	38	If is possible indicate the ocean regions where acidity is higher. [Government of Mexico, Mexico]	Noted - This should be covered in Chapter 5. Unfortunately, it cannot be covered in the framing chapter due to space constraints.
22443	1	12	37	12	37	Suggest adding 'more than' before 26%, given than this number was published well before 2011. [Government of Australia, Australia]	Rejected - this number comes from AR5 report.
29777	1	12	37	12	37	I suggest mentioning why oxygen concentrations decreased as this is not evident; i.e. "in response to in responses to changes in ocean circulation and respiratory demand as well as warmimg" [Dorte Krause-Jensen, Denmark]	Noted - Thanks for the suggestion but Chapter 1 is framing, this topic is being assesed in Chapter 5.
3155	1	12	38	12	40	Although AR5 didn't come to a conclusion regarding potential long-term changes in ocean productivity, does this report present any new information that could resolve the issues of short observational records and divergent scientific evidence? If not, how can these issues be resolved? [Sloane Garelick, United States of America]	Rejected - This chapter is about framing the report and not about making the assessment. Chapter 5 actually reassesses the changes in productivity and comes to a the conclusion that no significant changes have been observed (yet).
5577	1	12	38	12	40	AR5 lack of consensus on long-term ocean productivity changes is referred to but no statement is made about evidence since then. It is not clear why and it would be helpful for readers to know why. [Judy Lawrence, New Zealand]	Rejected - This chapter is about framing the report and not about making the assessment. Chapter 5 actually reassesses the changes in productivity and comes to a the conclusion that no significant changes have been observed (yet).
13739	1	12	38	12	40	Has SROCC provided any more information on ocean productivity? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected -This chapter is about framing the report and not about making the assessment. Chapter 5 actually reassesses the changes in productivity and comes to a the conclusion that no significant changes have been observed (yet).
26315	1	12	39	13	4	Sea ice thickness and volume should be discussed in the same section as sea ice extent. [Ethan Pierce, United States of America]	Taken into account - Good point: We added the reference AMAP (2017) in Section 1.4.2 and quoted the decrease in ice thickness, mainly old ice (second year and older).
4333	1	12	40	12	40	maybe change 'over the next century' to 'over this century' [The UBern Team Group Review, Switzerland]	Noted - the text has been revised.
11639	1	12	40	12	41	It would be convenient to mention that deoxygenation is expected with low confidence, at regional scales, especially in the tropics. (as was done in the summary) [Government of Mexico, Mexico]	Noted - Thanks for the suggestion but Chapter 1 is framing, this topic is being assesed in Chapter 5.
25921	1	12	43	13	22	Reduce or eliminate these sections or make much clearer what is just AR5 results and what is new. I found tihese sections highly confusing. The material is presented as if it were the newest results but it appears that much of it is just AR main conclusions. I don't see the purpose of these section. Comparisons to AR5 are better made in the chapters where these 'old' results can bve contrasted with the new findings. [Regine Hock, United States of America]	Agreed: Most AR5 statements have been removed.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29599	1	12	43	13	22	It seems to me that the introduction to this section needs to be clear that it is reviewing what is in past assessments and that what is presented in this report comes later than here. This notion of only 1 per 100 year ice free summers if the increase in global average temperature stays below 1.5 C seems to me a very serious underestimate--if we will get to 1, it is awfully hard to understand how there could be enough re-formation of ice to come back--basically, the situation would be oscillating awfully near where most ice was gone. How this statement represents a plausible projection needs, in my view, an awful lot more explanation and justification (making clear that, strictly speaking, this is referring to a full 3 months of no ice cover (so the whole summer being less than some small percentage, like 1M square km) and that there could be many more years where the sea ice cover drops to less than the percentage for a month or so, etc. I just that the explanation of what was meant in the 1.5 C report was not very helpful, and the explanation here does not help clarify what is meant here (and I may have it all wrong, which is just more reason to provide a clearer explanation). [Michael MacCracken, United States of America]	Agreed: We made major changes in this section and no longer review the AR5 assessments but give more general statements of the changing cryosphere.
1093	1	12	45	12	47	Melting permafrost and associated CH4 release seems to be missing here. [George Burba, United States of America]	Agreed: We added a sentence mentioning permafrost and methane.
13741	1	12	45	12	47	So has the SROCC provided an update or even confirmed the findings of the AR5? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	We made major changes in this section and no longer review the AR5 assessmenrts but give more general statements of the changing cryosphere. We do not make an assessment in the framing chapter. This part has been further reduced, now we just mention some parameters of change.
16661	1	12	45	12	47	I suggest adding something like "High mountain snow and permafrost were not addressed specifically in AR5, in contrast to SROCC Chapter 2". [Samuel Morin, France]	Agreed; we added a sentence accordingly.
25917	1	12	45	12	47	Seasonal snow should not just be squeezed in here in the glacier/ice sheet section. It deserves its own paragraph including more information. [Regine Hock, United States of America]	Agreed: we made a separate paragraph.
1603	1	12	49	12	52	Ice-volume is considered to be a more important factor than sea-ice extent. Are there metrics that can be referenced to reflect this? In addition, are there any metrics about the reduction in multi-year sea ice, which is also considered to be more important than sea ice extent. [Nora Richter, United States of America]	Good point: added a sentence from AMAP 2017.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17497	1	12	49	13	2	Emphasize the difference (and benefit) to limiting warming to 1.5 ºC compared to 2 ºC in the context of Arctic sea ice; while a one-off event if warming kept below 1.5ºC, an ice-free Arctic becomes a recurring event with 2ºC of warming. See Arctic Monitoring and Assessment Programme (AMAP) (2017) SNOW, WATER, ICE, AND PERMAFROST IN THE ARCTIC: SUMMARY FOR POLICYMAKERS; Sanderson B. M., et al. (2017) Community climate simulations to assess avoided impacts in 1.5 and 2 ºC futures, EARTH SYSTEM DYNAMICS 8:827–847; Screen J. A. & Williamson D. (2017) Ice-free Arctic at 1.5ºC?, NATURE CLIMATE CHANGE 7:230–231; Jahn A. (2018) Reduced probability of ice-free summers for 1.5 °C compared to 2 °C warming, NATURE CLIMATE CHANGE 8:409–413. [Kristin Campbell, United States of America]	Good point: We added the reference AMAP (2017) and quoted the decrease in ice thickness, mainly old ice (second year and older).
17597	1	12	49	13	2	Emphasize the difference (and benefit) to limiting warming to 1.5 ºC compared to 2 ºC in the context of Arctic sea ice; while a one-off event if warming kept below 1.5ºC, an ice-free Arctic becomes a recurring event with 2ºC of warming. See Arctic Monitoring and Assessment Programme (AMAP) (2017) SNOW, WATER, ICE, AND PERMAFROST IN THE ARCTIC: SUMMARY FOR POLICYMAKERS; Sanderson B. M., et al. (2017) Community climate simulations to assess avoided impacts in 1.5 and 2 ºC futures, EARTH SYSTEM DYNAMICS 8:827–847; Screen J. A. & Williamson D. (2017) Ice-free Arctic at 1.5ºC?, NATURE CLIMATE CHANGE 7:230–231; Jahn A. (2018) Reduced probability of ice-free summers for 1.5 °C compared to 2 °C warming, NATURE CLIMATE CHANGE 8:409–413. [Durwood Zaelke, United States of America]	Good point: We added a statement about the decrease in ice thickness in the Northern Hemisphere, mainly the loss of old ice (second year and older).
292	1	12	49	13	4	Although sea ice extend is more easily measurable and has a longer observational record, it is increasingly being shown that sea ice thickness and/or age is more indicative of the climate. Sea ice thickness may also better predict the rate of see ice decline, as older ice is stronger/more stable than new ice. [Ethan Kyzivat, United States of America]	Good point: We added a statement about the decrease in ice thickness in the Northern Hemisphere, mainly the loss of old ice (second year and older).
302	1	12	52	12	52	The last 1450 years doesn't seem very significant, especially since it was within the present glacial cycle. Could you give a statistic on how this rate of sea ice decline with previous glacial/interglacial cycles? [Ethan Kyzivat, United States of America]	Agreed; This sentence has been deleted.
16469	1	12	54	12	54	References to SR1.5 ("SR1.5" and/or "Allen et al") should be harmonized throughout the Chapter. It should be clear from the beginning of the Chapter that it is the most recent IPCC product to which reference is made. [Georg Kaser, Austria]	Agreed: A sentnece has been added to make that statment.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29023	1	12	54	13	2	The actual statement in SR1.5 was that at 1.5 degrees, ice-free summers would occur AT LEAST once every 100 years, and AT LEAST once every 10 years at 2 degrees. While technically accurate because of the "at least" qualifier, it does not accurately reflect current published research, which strongly indicates more frequent ice free summers even at 1.5 degrees (see comment Row 31, below). Suggest this reference be removed or revised in consultation with sea ice experts working on Ch. 3, as it is an essentially inaccurate representation from the SR1.5 that if anything, should be diplomatically corrected by the SROCC. In this connection, see also final comment in Rows 75-79, below. [Pam Pearson, Sweden]	Agreed: good point. We changed the text to reflect your accurate language of the SR1.5, however, we did not add more text other than the SR1.5 statement, since we do not make an assessment in the framing chapter.
1297	1	13	2	0		"increasing Antarctic sea ice extent were observed" is grammatically incorrect. "had been observed" would be the correct tense. Alternatively, "At the time of AR5, observations indicated sea ice extent was increasing, though with..." [Jacinta Clay, United States of America]	Agreed: Text has been revised and this sentence had been deleted.
5579	1	13	6	13	13	The significance of these lines is not brought forward sufficiently into the executive summary of this chapter. Could this be done at page 3 text line 33 add ice sheet mass to the list and add part of the statement page 13 lines 6-13 after this addition in the exec summ. [Judy Lawrence, New Zealand]	Agreed - but all this information was already published in AR5 and we reduced this part considerably.
18357	1	13	6	13	13	There is high uncertainity in figures 30+/-67 and 34+/-40. Is there any other way to simplyfy these uncertainities. I am not sure whetehr these uncertanities were pciked up from the most recent IMBIE experiement. Thi experiement combines all the estimates from laser, radar and other means. [APECS Group Review, Germany]	Taken into account. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results
11617	1	13	7	13	11	Over the period 2002 to 2013 the accumulated loss Greenland ice sheet was 2,015 Gt yr^-1. What is the percentage of total? [Government of Mexico, Mexico]	Taken into account. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results
1299	1	13	11	0		"these losses" makes me think that the report is referring to both the Greenland and Antarctic Ice Sheet, when in fact only the Antarctic Ice Sheet is being referenced. "This loss" might be a better phrase or maybe "Antarctic ice loss" which would remove all doubt. [Jacinta Clay, United States of America]	Taken into account. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results
1301	1	13	12	0		Both "ice" and "sheet" should be capitalized in "West Antarctic Ice Sheet" [Jacinta Clay, United States of America]	Taken into account. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results
8721	1	13	13	0		Suggest inserting 'the' infront of 'development' [Nina Hunter, South Africa]	Taken into account. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results
26949	1	13	13	13	13	Reference to 'across IPCC reports' - better to say something like 'across successive IPCC reports' [Liz Dovey, Australia]	Accepted. We made this change
16663	1	13	15	13	15	The wording "are continuing" is vague. What is the time frame for it ? [Samuel Morin, France]	Accepted.: We added "since AR5"
536	1	13	17	13	17	Why not +-135 for these estimates, in keeping with previous notation? [Jenna Pearson, United States of America]	Noted. We deleted this sentence as we reduced this part considerably as it only stated the AR5 results

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
296	1	13	18	13	19	Instead of the connecting word "although," you could use "and" or rewrite as "...with a regionally varying rate of increase." The word "although" establishes a contradiction between the two clauses, which doesn't need to be highlighted. [Ethan Kyzivat, United States of America]	Accepted. We made the revision
32845	1	13	25	13	25	Section 1.5.1 seems to be mislabeled and out of place. The words ocean and cryopshere need to be in the heading, since not all natural systems are covered. Also consider adding "risks and vulnerabilities" to the section title. [Government of United States of America, United States of America]	Noted. Section 1.5.1 is the first subsection from 1.5, which already has Oean and Cryosphere listed. so logically 1.5.1 is assumed to be for the same domain and it is not necessary to list Ocean and Cryosphere in every sub-heading.
21901	1	13	25	20	21	Lots of good material of risk and vulnerability including definitions - but is lacking from the background framing of the problem, which is we are facing increasing rising risk with time (due to ongoing acceletating SLR), so for example the convential static approach to hazards (e.g. return periods) and convential cost-benefit analyses for evaluating response options, often is not cognizant of the changing and widening uncertainty on future risk. [Robert Bell, New Zealand]	Noted -- The framing has undergone revisions since SOD to now more strongly emphasize the challenges with widening uncertainty and the potential limits of current management appraoches to deal with uncertainty effectively.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14905	1	13	25	23	41	The concepts of hazard, risk and impacts are not used consistently within this section and in comparison with the Glossary definition. This also highlights complications arising from the new definitions and framing. For example, on p 13 ln 28, impacts refer to "materialized risks" while the glossary speaks of realized risks; p 13 ln 51 defines "hazards" as "environmental hazards triggered by climate change" which leads to the question of how to define a hazard, and where consequences of climate change fit that can not directly be qualified as "hazardous" (e.g. is a range shift of marine species automatically a hazard, e.g. "a potential source of danger"; what about potentially positive effects such as higher ecosystem productivity)? On page 22, line 23 it is stated that "Climate change impacts on the ocean and cryosphere also present opportunities, in at least the near and medium term.", which is perfectly logical with the old definition of impacts (effect or consequence of climate change) however seems to contradict the new definition of "impacts" based on "realized risk" which in turn stems from a "hazard". It takes some very twisted thinking to arrive at the conclusion that the outcome of a hazard could actually be beneficial, as suggested in the last line of the Glossary definition. While we appreciate the intention to clarify the different components of risk, it seems that the concept is more suited to the world of extremes and disaster risk management (from where it originates) than to that of gradual change and future projections, and introduces substantial complication and difficulty with the more established use of the terms "risk" and "impact". As the new definition is already approved and part of the (SR1.5) glossary, we strongly encourage the authors to provide some more explanation on the composition and definition of "hazard", as it seems that most of the what was used to be called "impacts" is now wrapped into that category, e.g. ecosystem changes. It would also be helpful to understand how "realized risk" relates to future projections, as that distinction is intuitive for past events but not necessarily for the future. It seems that thoroughly editing the whole report in order to ensure that the terms "risk" and "hazard" are consistently and correctly applied, and the word "impact", unless referring to observations, is substituted by formulations like "Changing hazard" or "potential effect of an environmental hazard, depending on exposure and vulnerability", is warranted to ensure consistency. [Government of Germany, Germany]	Accepted -- Thank you very much for these thoughtful comments. The definitions have been revised and streamlined accordingy. Particularly, the defintion of the term "impacts" has been changed to refer to "effects" of climate change, also allowing for positive effects.
29601	1	13	27	13	27	The phrasing here seems very one-sided, just looking for adverse impacts and not also for lack of adverse impacts. It would seem appropriate to do a bit of rewording. [Michael MacCracken, United States of America]	
1889	1	13	27	13	28	the definition of "impacts" as materialized risk is inconsistent with the SROCC glossary (unless realized and materialized has the same meaning, which is not my understanding of the words), and it is inconsitent with the definition of "impacts" in AR5 which refers to effects and thus can also include positive impacts. I know that SR1.5 uses the same definition of impacts as SROCC, but I would argue that the AR5 definition was broader (and more suitable) to also include positive effects/impacts. [Jana Sillmann, Norway]	Accepted -- The definition has been changed and now uses the term "effects", including the possibility of positive effects.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27117	1	13	28	13	28	This may cause more confusing. Can 'impact' be considered as a consequence? Meanwhile, when talking risks, it normally also defines the "carrier" that bears the risk. [XIAOMING WANG, Australia]	Noted. The following sections define the "carrier" and we therefore believe it is clear enough, but the text and section headings have also been revised.
30499	1	13	35	20	23	Please remove all the specific references to the glossary in this CCB. It is sufficient to refer to the Glossary for definitions once in the beginning (as done on page 13 in lines 46-47) [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- Text has been changed accordingly
5581	1	13	37	15	48	This box mixes attention to humans and human systems. They are different things. What seems missing is acknowledgment of human institutions as in norms, practices, statutory frameworks etc. Vulnerability seems to be focused on human beings and structures like infrastructure. None of these can exist successfully without governance, institutions that are fit for the problem Ref Young, O. (2002). The Institutional Dimensions of Environmental Change: Fit, interplay, and scale. Cambridge Massachusetts and London: MIT Press; and Institutional Dynamics Global Environmental Change 20 (2010) 378–385. The box could be amended to make these distinctions clearer and the centrallity of governance and institutions [Judy Lawrence, New Zealand]	Accepted -- this aspect has been added to the text and second figure.
5243	1	13	37	20	21	Cross- Chapter Box 1 is excessively long [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account -- The text has been shortened and the figures condensed.
12057	1	13	37	20	21	The BOX in this chapter (this report) is too long, which cuts off the logical connection between chapters. In addition, the boxes in previous IPCC reports do not include a list of citations. So it is suggested to delete such a list as well as significantly shorten the BOX. [Government of China, China]	Taken into account -- The text has been shortened and the figures condensed. The references have been cut here and inserted into the main list of references of chapter 1.
16471	1	13	37	20	21	The Box seems to be considerably too long and I wonder, how much it really extends from AR5 WG2 on the topic. If so, it should be made clearer what is new since AR5. Interestingly, AR5 WG2 SPM is not even cited in the X-Box as reference and starting point while the figures are adapted from there. [Georg Kaser, Austria]	Taken into account -- The text has been shortened and the figures condensed. The figures are adapted from both the SPM as well as the main text of AR5 WGII -- in fact the SPM risk figure in AR5 is directly referenced to Chapter 19 of AR5 WGII, which makes sense since this chapter provides the deeper context. Reference to that chapter has now been explicitly included into the figure caption here (i.e. in CCB2 of SROCC).
25301	1	13	37	20	21	This is a very good cross-chapter box. I'm pleased to see the focus, up front, on the human system considerations related to adaptation, development, and governance. The ocean system has long suffered from incomplete or ineffective governance, and a new outlook on how to achieve collective global goals will be needed to take action on ocean climate change and its consequences for humanity. This cross chapter box sets the tone for that change. Relatedly, Cross Chapter Box 2 provides a nice follow-on to Box 1. [Sarah Cooley, United States of America]	Noted -- Thank you.
30607	1	13	37	20	21	This box is impressive from an academic point of view but lacks the transfer to implementation. How would we best link the level of risk to the degree and success of adaptation as well as the limits of adaptation and residual risk. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into consideration -- these valuable aspects have been inlcuded and are now stressed in the figures and text.

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32847	1	13	37	20	23	Cross-Chapter Box 1 on key concepts lays a great foundation for this report. The concept of climate-resilient development pathways first appeared in the IPCC WGII AR5 SPM and Chapter 1 (Figure 1-5). Figure 3 of the box is very similar (partly identical), which should be clearly cited in this text box as "modified from IPCC WGII AR5" and described in the introduction to CRDPs. [Government of United States of America, United States of America]	Accepted -- a reference to Figure SPM.9 of AR5I WGII has been added
4965	1	13	38	12	39	If AR5 did not come to a final conclusion on long term changes of primary productivity, has SROCC done this? If no, this should be stated and reason provided. [Debra Roberts and Durban Team, South Africa]	wrong page number, belongs to 1.4 => Niki and Jake
30497	1	13	44	13	44	Please provide full title plus acronym SROCC here in this Cross-Chapter Box once again [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- The text has been changed accordingly
28321	1	13	46	13	46	for the report and FOR the assessments…. [Anne GUILLAUME, France]	Accepted -- The text has been changed accordingly
24331	1	13	56	13	57	Consider replacing "a central way" with "a key avenue" and "to reduce risk and exploit" with "to reduce risk and galvanize" [Philippus Wester, Netherlands]	Accepted -- the text has been changed in accordance with the first part of the comment. The formulation "exploit opportunities" is widely used in the literature. The text has therefore been kept.
27119	1	13	57	13	57	In the box, "exploit new opportunities" is not really demonstrated and explained. All are basically discussing the risk management. More clarification would be good. [XIAOMING WANG, Australia]	Taken into account -- the text has been revised to clarify this point.
15223	1	14	0	0		Also include reference to Section 6.4.3 which discusses barriers to adaptation related to ocean and cryosphere changes [Government of Gambia, Gambia]	Accepted -- A reference has been added
4257	1	14	0	14		This figure is confusing. E.g. Land-use planning and EWS are listed as reducing exposure risk but not vulnerability risk? I think the main problem is with the much-debated AR5 propeller graph, but this figure makes it even more confusing in my view [Manuel Barange, Italy]	Noted. However, in keeping with the logics of the AR5 risk framing, early warning as well as land use planning primarily take effect to reduce the exposure of people, infrastructure and other assets, not the base-line vulnerability. The core vulnerability or a person, for instance, is still unchanged by the fact that it is warned of an incoming storm and can get itself out of harms ways (i.e. reduce its exposure). If the early warning system fails, the person is still exposed. In that case, the early warning system has not changed the vulnerabiliity of that person -- to stay within the example.
13747	1	14	0	14		There are grey lines on the right hand side of the diagram which look like they should lead to other elements of a diagram, is there something missing from the figure? Is there a way of showing on the diagram that adaptation can reduce risk with more than one of the risk factors? The figure appears as though only one at a time is plausible. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account -- The figure has been revised.
18347	1	14	0	14		"Figure 1" Is something missing because the right portion of the figure seems like incomplete [APECS Group Review, Germany]	Taken into account -- The figure has been revised.
21643	1	14	0	14		Cross-chapter Box 1, Figure 1 is thought to be well-structured to help us understand the adaption and risk. I hope that this concept should be applied to the AR6 WG-II as well. [Government of Republic of Korea, Republic of Korea]	Noted, thank you.
22617	1	14	0	14		Cross-chapter Box 1, Figure 1 is thought to be well-structured to help us understand the adaption and risk. I hope that this concept should be applied to the AR6 WG-II as well. [IN-SEONG HAN, Republic of Korea]	Noted.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1305	1	14	1	0		This is an excellent schematic, but I wonder if it would be worth it to use some of the whitespace on the left to list Potential Hazards of climate change (heat waves, sea level rise, higher intensity hurricanes, etc…) and/or factors related to vulnerability or exposure. [Jacinta Clay, United States of America]	Taken into account -- The figure has been revised. However, the aim of the figure is to focus on the actions that can be taken to reduce hazard/vulnerabillity/exposure, not on listing these as such.
78	1	14	1	14	1	Cross-chapter box 1, fig. 1: What are those little pitchforks on the right hand most side of the figure? [Baylor Fox-Kemper, United States of America]	Taken into account -- The figure has been revised.
13743	1	14	1	14	1	Can future vulnerability always be prevented or should the text refer to limiting or reducing vulnerability? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted -- the text has been changed accordingly.
5245	1	14	1	14	12	Figure 1: In "Options to reduce vulnerability maybe included environmental protection". In "Options to alleviate hazards locally (other than climate change mitigation)" I propose add - coastal mangroves and coral reefs conservation and restoration to alleviate coastal storm energy [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account. This is surely a relevant example. However, due to space restrictions it cannot be listed here.
3483	1	14	5	14	5	The overall content of cross-chapter box 1 is excellent. However, I am struck by the phrasing "inevitable surprises." While I believe what you are trying to convey is entirely logical (i.e. that unexpected events are unavoidable), I think the phrase is a bit counter-intuitive. Rather, such phrasing as "unavoidable" or "unexpected" events may work better. [Katherine Bishop-Williams, Canada]	Accepted -- the text has been changed accordingly.
13745	1	14	5	14	5	What do 'inevitable surprises' refer to in the text? It is unclear what this means. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted -- the text has been revised to clarify this point.
31567	1	14	8	0		Cross-Chapter Box 1, Figure 1. Layout could be rearranged in order to avoid repetitiveness of the propeller icon. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- The figure has been revised.
31569	1	14	8	0		Cross-Chapter Box 1, Figure 1. The concept/intension is not clear for the open-ended arrows that are leaving each of the propellers at the right. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account -- The figure has been revised.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28445	1	14	8	14	12	While this figure usefully illustrates the different options for risk reduction, it does not indicate that there are limits to such reduction (adaptation) and residual risks and therefore fails to provide a comprehensive picture. The issue is covered (with room for improvement) in the ensuing paragraphs and has widely been recognized in previous IPCC reports (SR1.5 and AR5 WG2). One way to ameloriate this incomplete picture would be to insert a second figure in this CC Box to illustrate the concept of limits to adaptation and residual risks (e.g. as done in AR5 WG2). Alternatively, a new figure should be conceptualized, which should indicate (i) the specific limits to adaptation for different sectors and regions at different levels of warming identified throughout the report (e.g. chapter 2 identifies limits to adaptaion in high mountaneous regions) (ii) the different types of losses described in the literature and relevant chapters (e.g. as presented in Figure 4.12 and Box 6.1) and, to the extent possible, (iii) potential responses to such losses [Government of Saint Lucia, Saint Lucia]	Taken into account -- the figure has been revised to include limits to adaptation and give a range of dimensions covered. However, for space concerns and this being a conceptual figure, it is not feasible to include a wide range of specific limits for individual sectors, regions etc.
4335	1	14	8	14	40	What do the lines on the righ-hand side of the risk diagrams show? [The UBern Team Group Review, Switzerland]	Taken into account -- The figure has been revised.
18161	1	14	8	14	9	I love this figure for introducing the framework for risk language. On the far right the brraches of the tree split again to form three sub-branches each. Is that an artifact from an earlier version? [APECS Group Review, Germany]	Taken into account -- The figure has been revised.
26893	1	14	8	14	9	Examples of adaptation options suggested in the Fig is too generic, without giving any reference or cntext, not make much sense to me. [Golam Rasul, Nepal]	Taken into account -- It would be ideal to bring in further context. However, due to space restrictions this has proven not to be feasible.
26951	1	14	8	14	9	The examples given in each of the categories can arguably belong in other categories. E.g. the example in measures to reduce hazard of 'water reservoirs to buffer low-flows and water scarcity' is actually an example of a measure to reduce exposure (eg to drought) and should be in the category above - it doesn't reduce the drought itself, which is implied in the figure. The meaning of the prongs to the right of the figure is unclear.. [Liz Dovey, Australia]	Taken into account -- Thank you for this valuable comment. It is a question of scale. In certain places, having a water reserviour upstream can buffer low flows and hence water scarcity. This is the context in which the example is discussed in mountain chapter.
28323	1	14	8	14	9	This is an important figure that needs to catch a general audience WITHOUT having to read the text of the report. Here some suggestion: 1) in the colored pieces, add environmental to hazards, system to vulnerability and human to exposure, at least in the left part; 2) It should also be clear that risk is reduced, may be coloring in red the inside of the rsk dotted part (and why not in green the gain). [Anne GUILLAUME, France]	Taken into account -- The figure has been revised in response to the second part of the comment. In terms of the key terms (hazard, exposure, vulnerability) there has been a conscious choice to stick to them -- and not add additoinal qulifiers -- as they have been used in AR5 and other Special Reports.
16473	1	14	9	14	9	to which extend doe this Figure and Figure 2 in the Cross-Chapter Box 1 add to AR5 WG2 SPM.1 and SPM.8? [Georg Kaser, Austria]	Taken into account -- the figures have been revised and clear statements on the developments since AR5 added.
16769	1	14	9	14	9	What is the purpose of the three "forks" on the right hand side of each smaller propellors ? I think the figres would be better without them. [Samuel Morin, France]	Taken into account -- The figure has been revised.
16847	1	14	14	15	22	A separate heading "limits to adaptation and residual risks" would be helpful to frame these paragraphs. At the moment, limits to adaptation are summarized under "adaptation" which is conceptually and logically inconsistent. [Government of Grenada, Grenada]	Taken into account -- However, due to space limitations, teh number of sub-sections is limited and no further sub-heading could be added.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28447	1	14	14	15	22	A separate heading "limits to adaptation and residual risks" would be helpful to frame these paragraphs. At the moment, limits to adaptation are summarized under "adaptation" which is conceptually and logically inconsistent. [Government of Saint Lucia, Saint Lucia]	Taken into account -- However, due to space limitations, teh number of sub-sections is limited and no further sub-heading could be added.
25383	1	14	15	14	19	I fully agree that adaptive capacity indicates potential, not necessarily effective adaptation – an excellent and important point to make. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted -- Thank you.
29891	1	14	16	14	16	Be clear that this means "technological" in the broadest sense, or else expand to include "knowledge" [Anna Zivian, United States of America]	Taken into account -- The text has been revised accordingly
26895	1	14	21	14	21	"There are limits to adaptation, which can be physical, ecological, and/or socio-cultural". Better to add technological and economic as well. Many options avialbale but may not be technologically feasible or economiclly unvaiable or not cos-effective. [Golam Rasul, Nepal]	Accepted -- the text has been revised
30555	1	14	21	14	25	Could you give an example of a social limit as well? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- A very good suggestion. An exmple has been added.
18169	1	14	22	14	22	The Dow article is an opinion piece, so citing only Klein may be preferrable. Alternatively, this journal article might be an adequate replacement for the Dow article: Barnett, Jon, Louisa S. Evans, Catherine Gross, Anthony S. Kiem, Richard T. Kingsford, Jean P. Palutikof, Catherine M. Pickering, and Scott G. Smithers. "From Barriers to Limits to Climate Change Adaptation: Path Dependency and the Speed of Change." Ecology and Society 20, no. 3 (2015). http://www.jstor.org/stable/26270227. [APECS Group Review, Germany]	Accepted -- The reference has been assessed and added.
1307	1	14	24	15	1	I'm a climate scientist so I find the term "adaptive capacity" jargony. Would "Barriers can in principle be overcome, especially when adaptation-related resources are available. Overcoming barriers is often hard in reality" be equally correct? Alternatively, would condensing the phrase to "Barriers can in principle be overcome, though overcoming barriers in often hard in reality..." be appropriate? [Jacinta Clay, United States of America]	Taken into account -- However, we note the term is widely used in the adaptation literatire and there is a need here to be conceptually consistent with that literature. It has also been used in previous IPCC reports.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
15225	1	15	0	0		Greater connections to discussion of residual risks, impacts and loss and damage that are included in other chapters can be made in this section. In particular, Section 6.3.2 and Table 6.2 include extreme events linked to ocean and cryosphere that have been attributed to climate change with associated impacts and costs. Box 6.1 contains case studies of impacts that have already been experienced from compound climate events. These should be referenced in this section to highlight that loss and damage is already being experienced and that there is further discussion of these issues in related chapters. Section 6.9.1 also specifically inlcudes discussion of governance approaches to loss and damage and should be referenced in this section. [Government of Gambia, Gambia]	Accepted -- the text has been revised and additional cross-references have been added.
8723	1	15	2	0		Take out "does"; change "allow" to "allows" [Nina Hunter, South Africa]	Taken into account -- The text has been revised accordingly
4967	1	15	2	15	2	Delete 'does' before 'no longer' [Debra Roberts and Durban Team, South Africa]	Taken into account -- The text has been revised accordingly
24333	1	15	2	15	2	Replace "does no longer allow" with "no longer allows" [Philippus Wester, Netherlands]	Taken into account -- The text has been revised accordingly
1309	1	15	7	0	9	Several comments on residual risk as it is used in the first two sentences. 1) I find the term residual risk (implying a risk that remains after an event, like a residue) more intuitive than the description that follows it in parentheses. Moreover, I think the parenthesis make the sentence choppy and more difficult to read. 2) It seems odd to me that a word is defined in one sentence and then in the next sentence the reader is referred to the glossary to learn more about it, specifically its bearing in geopolitical debate. 3) The term in not defined in the SROCC glossary. I would suggest in lieu of these two sentences "Risks may endure adaptation efforts, even when adaptation is possible ***citations, likelihood and robustness description****. These risks are called residual risks." It is less confusing and shorter. [Jacinta Clay, United States of America]	Taken into account -- Thank you for these thoughtful comments. on 1) The term is used here -- along with the literature -- in the defined way. on 2) Reference to the glossary has been erased. on 3) An addition to the glossary is considered with the the wider author team.
14907	1	15	7	15	22	The way this paragraph is phrased gives the impression that the SROCC directly relates to the institutional arrangements of the UNFCCC WIM. In particular, in line 13 ff, it should be made more clear that the report discusses processes and issues that are of relevance for the work of the WIM, but that it is not the WIM strategic work streams that are being taken up in the relevant chapters. We do not really see why the WIM is being invoked here in the first place as other UNFCCC bodies are not referred to. But if the connection is seen necessary by the lead authors, care must be taken to clarify the boundaries between the scientific assessment provided here, and the political process under UNFCCC: It is the scientific findings rather than the political process which should serve as the structuring principle for assessing the evidence. [Government of Germany, Germany]	Taken into account -- Thank you very much for these thoughtful comments. The text has been changed accordingly to stress the role of loss and damage in the scientific assessment of this report.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
30531	1	15	7	15	22	Refer here to cross chapter box 12 in chapter 5 of SR15 [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- the reference has been added.
17277	1	15	16	15	16	In the text here, it is noted that the Warsaw International Mechanism (WIM) for Loss and Damage encompasses "the interconnected relationship with, and reliance upon, the land, water, and ice for culture, livelihoods, and wellbeing in the Arctic". However, the WIM's focus is on developing country parties as is clear by language that specifically notes developing countries in in the UNFCCC decision 3/CP.18. and decision 2/CP.19. As such, the text should be to changed to reflect that non-economic losses including the interconnected relationship with the land, water, ice etc. is encompassed in loss and damage, not encompassed in the WIM specifically. [Joanna MacDonald, Canada]	Taken into account -- Thank you very much for these thoughtful comments. The text has been changed accordingly.
8725	1	15	18	0		State number of cross chapter box [Nina Hunter, South Africa]	Taken into account -- However, the authors have difficulties to follow the comment. There is no reference to a CCB on page 15, line 18.
13749	1	15	24	15	24	Building Resilience', is there definition for what this refers to? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account -- An explanation of resileince consistent with glossary definition is contained in the first paragraph, with the core in sentence 3, introduced with "resilience is understood".
32347	1	15	24	15	46	For many years in climate literature, the term 'resilience' is being used to cover both 'resistance to change' and 'resilience to recover from impact'. This text shows how difficult it is to use the term 'resilience' with two meanings. For example, in line 35 'resilient in keeping its unfavoured attributes' is a nonsense. This would read far easier if it was 'resistant to change in its unfavoured attributes'. This report is an opportunity to correct this language and use the term 'resistance' to mean 'resistance to change' (which could be positive or negative) and 'resilience' for ability to recover from impact. [Andrew Constable, Australia]	Taken into consideration. We appreciate this valuable comment. However, the current text is consistent with the literature. While the outcome may be a resistance to change, the system capacity (which is discussed here) is resilience, which is "neirther good nor bad".
29893	1	15	24	16	20	in this section, add a sentence defining resilience and refer to glossary [Anna Zivian, United States of America]	Accepted -- a glossary link is now included. See also response to 13749
3405	1	15	25	15	38	This section summarizes the state of an academic debate without providing any analysis or reaching any obvious conclusions. It is unclear whether the SROCC is presenting any outcomes of this debate or merely documenting a current field of activity. [Patrick Orenstein, United States of America]	Taken into conideration -- The purpose of the text is to explain understanding of resilience in the literature that is relevant for SROCC and for the IPCC risk framework. IPCC reports do not settle academic debates.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25385	1	15	25	15	38	excellent to see support for and also critique of socio-ecological resilience – a very nice box. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted -- thank you!
30609	1	15	40	0		Here and elsewhere term "natural systems" requires differentiation for clarity as systems exposed to risk clearly relate to ecosystems and human systems, i.e. something of value being impacted by climate change. It seems that often term natural system is used instead of ecosystems, however term natural systems is less meaningful. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted -- The term natural systems has been replaced by ecosytems or ecological systems.
32349	1	15	40	15	40	The term 'resilience thinking' is jargonising a concept of necessarily including consideration of 'resilience/resistance' in planning mitigation and/or adaptation measures. It adds a term to the lexicon unnecessarily and will only confuse policy makers because of the disagreements that will be had in what it means and to what extent resilience needs to be considered in particular cases. [Andrew Constable, Australia]	1st part: accepted. The text has been revised. 2nd part: rejected. Resilience-thinking / assessing resilience is being applied in both analysis and practice to inform planning / adaptation planning/ sustainable development.
13751	1	16	0	0	16	Language in figure could be simplified and made clearer. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
4259	1	16	0	16		I find this figure extremely complex. What are we telling a policymaker? That they have different options if they focus on governance rather than system attributes? Or that they should focus on learning if they care for dynamics and polycentric governance if structure is their goal? I dont see the added value [Manuel Barange, Italy]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
31571	1	16	1	0		Cross-Chapter Box 1, Figure 2. Missing explanation for the multi-arrow circle at the center of the figure. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
31573	1	16	1	0		Cross-Chapter Box 1, Figure 2. In the white box about slow variables, is says that it "forces attention on...", perhaps here you may chose a diferent verb than "forces" because it maybe confused with the " forcing" concept already introduced ealier in the chapter. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
3433	1	16	1	16	1	Figure has too much text to be effective. A number of terms appear to be undefined, such as "polycentric governance" and "complex systems understanding". [Patrick Orenstein, United States of America]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
11377	1	16	1	16	1	I don't understand what do the arrows at the center of the figure mean (i.e. they are confusing). Do they represent interaction or something else? [Anson Cheung, United States of America]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28325	1	16	1	16	1	I would siggest to add in the "blank box, top left corner "strategy to enhance resilience", and in each of the 4 column/ligne labels replace "focus" by "focussed". This will help understanding the figure without reading the caption [Anne GUILLAUME, France]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
32015	1	16	1	16	1	The way "Complexity" is currently described, it would appear to belong in the right bottom quadrant as having a focus on system attributes. Either the focus on governance aspect needs to be made clear or the item moved to the lower quadrant. [Christian Reuten, Canada]	Taken into consideration -- the figure has been merged with the third figure and has undergone fundamental revisions.
5247	1	16	10	16	20	I propose the following text in addition to text written: " In response to the vulnerability of Caribbean SIDS to the impacts of climate change, the Heads of Government (HOG) of the Caribbean Community, CARICOM (an inter-governmental body comprising fourteen independent countries and six British Overseas Territories), in July 2009 approved a 'Regional Framework for Achieving Development Resilient to a Changing Climate.' Three years later, in 2012, the CARICOM Heads approved an implementation plan for the Regional Framework"(from CARICOM, 2018 - Regional Strategic Action Plan for Governance and Building Climate Resilience in the Water Sector in the Caribbean", 14th High Level Forum of Caribbean Ministers Responsible for Water (HLF 14) 9th to 10th October 2018, Rose Hall Hilton Hotel, Montego Bay, JAMAICA) . To these high level meetings participated Cuba, Dominican Republic, British and American Virgin Islands, Turk and Caicos Islands, and other islands below Netherlands, France and United Kingdom protectorate [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account -- many thanks for these valuable comments and for suggesting this good example. Unfortunately, adding to the text has not proven feasible due to space restrictions
23009	1	16	14	16	14	Is the example on loss and damage information specifically relevant to SROCC? [Valerie Masson-Delmotte, France]	Taken into account -- Many thanks for this question and comment. It is, as it relates to cyclones, which play a great role in chapter 6. The text has been made more specific to that end.
34239	1	16	14	20	21	Should the literature list be moved to the overall list at the end of the chapter?. Applies to all cases where literature references are included in the box itself [Maria Jose Sanz Sanchez, Spain]	Accepted -- the references have been moved to the end of chapter 1.
1311	1	16	16	0		"post-disaster" [Jacinta Clay, United States of America]	Accepted -- text revised
13753	1	16	18	16	18	It is unclear what 'alternative sanctions' in this sentence means, this could be usefully clarified. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted -- the typo has been removed and the text revised to "alternative actions"

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24375	1	16	22	17	12	All these societal challenges regarding changes should be inscribed in the wider perespctive of the socio-environmental changes, where complexity is beyond the climate issues, and where societal levers are inscribed in a partly un-anticipated, contingent trajectory. A concise way to frame into this would be to refer to the two syntheisis and foresighting articles from the ICSU synthesis on the ANthropocene: Bai X., van der Leeuw S., O'Brien K., Berkhout F., Biermann F., Brondizio E.S., Cudennec C., Dearing J., Duraiappah A., Glaser M., Revkin A., Steffen W., Syvitski J., 2016. Plausible and desirable futures in the Anthropocene: A new research agenda. Global Environmental Change, 39, 351-362, http://dx.doi.org/10.1016/j.gloenvcha.2015.09.017 Brondizio E.S., O'Brien K., Bai X., Biermann F., Steffen W., Berkhout F., Cudennec C., Lemos M.C., Wolfe A., Palma-Oliveira J., Chen A. C-T., 2016. Re-conceptualizing the Anthropocene: A call for collaboration. Global Environmental Change, 39, 318-327, http://dx.doi.org/10.1016/j.gloenvcha.2016.02.006 [Christophe Cudennec, France]	Taken into account: discussion of complexity revised and citation added in the resilience part of the CCB.
27121	1	16	23	16	26	If we look back the definition of resilience, which is "the capacity of interconnected social, economic, and ecological systems to cope with disturbances, by reorganising in ways that maintain their essential function, structure, and identity". Would it be good to change it into … in order to cope with disturbances and reduce the subsequent disruption … [XIAOMING WANG, Australia]	Accepted. Text revised.
32295	1	16	23	16	26	The definition given here for Climate-resilient Development Pathways is here fine, but the definition given in the Glossary is not as good as this one, as it only focuses on adaptation. The Glossary needs to be made coherent with the chapter. [Jean-Pascal van Ypersele, Belgium]	Taken into acount: text revised to be consistent with SROCC Glossary.
5165	1	16	23	16	27	Include the need for social justice and equity as well (as outlined in SR1.5). [Debra Roberts and Durban Team, South Africa]	Taken into account: text revised to be consistent with SROCC Glossary, which includes aspects of justice and equity.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5583	1	16	31	16	31	Recent practice references should be added after the sentence on line 31 as follows."Tools for adaptive decision making are increasingly being applied in practice in coastal areas and adopted in national guidance for coastal hazards and climate change" Refs include Stephens, S., Bell, R., Lawrence J. 2018. Developing signals to trigger adaptation to sea-level rise. (2018). Environmental Research Letters. Published on line 7 September 2018. http://iopscience.iop.org/10.1088/1748-9326/aadf96; Lawrence, J, Bell, R, Blackett, P, Stephens, S, Allan, S. (2018) National Guidance for Adapting to Coastal Hazards and Sea-level Rise: Anticipating when and how to change pathway. Environmental Science & Policy [online]; Ramm, T.D.; Watson, C.S.; White, C.T. Strategic adaptation pathway planning to manage sea-level rise and changing coastal flood risk. Environmental Science & Policy 2018, 87, 92-101; Bloemen, P.; Van Der Steen, M.; Van Der Wal, Z. 2018. Designing a century ahead: climate change adaptation in the Dutch Delta. Policy and Society, 2018, 1-19. These new references take us further than the starting ones cited in the previous sentence on line 30 [Judy Lawrence, New Zealand]	Taken into account. List of references has been revised. Also taken into account in Chapter 1.
4261	1	17	0	17		I do not find this figure necessary. The say that a world with effective responses to climate change has a larger opportunity space for sustainable development than a world without affective responses does not need a 3/4 page-figure [Manuel Barange, Italy]	Taken into account. Figure revised.
23011	1	17	0	17		The small characters could show women and children too [Valerie Masson-Delmotte, France]	Taken into account. Figure revised (double-check later on!).
80	1	17	1	17	1	Cross-chapter box 1, fig. 3: Why are these people trapped in lampshades? Eliminate this figure--it is a waste of space for the small information content it carries. [Baylor Fox-Kemper, United States of America]	Taken into account. Figure was revised.
32297	1	17	3	17	4	The sentence emphasizes the importance of adaptation choices for CRDP, and refers to Denton et al. (2014)(of which I was a Review Editor), but that AR5 WGII chapter talks about adaptation AND mitigation, as referred to in lines 16-23 to 16-26. A better balance between mitigation and adaptation here would be in order. [Jean-Pascal van Ypersele, Belgium]	Accepted. Text revised.
29895	1	17	13	17	19	this is not a particularly useful figure -- the x-axis is time, but it appears to be just a reference, rather than exerting an effect on its own; in any case, the point is illustrated better in the text than in the figure [Anna Zivian, United States of America]	Taken into account. Figure was revised.
3435	1	17	14	17	14	The complexity of this figure makes it difficult to see the overall message What is meant by an "opportunity space"? [Patrick Orenstein, United States of America]	Taken into account. Figure and caption revised.

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14909	1	17	14	17	15	CC Box 1 Fig 3: This figure bears strong resemblance to Figure SPM.9 of the WGIIAR5, however in contrast to the representation in AR5 it is not clear here how the y-axis is defined, e.g. what is meant by "opportunity space for SD", what the decision points are and how climate policy and climate risk interact. Also, the graphic seems to suggest that mitigation comes without development constraints or risks, which may be perceived as biased. While we generally understand the intention of the graphic to visualize the limitation to SD development choices and pathways as a consequence of unabated climate change, we'd encourage the authors to find a clearer and more comprehensive visual representation. [Government of Germany, Germany]	Taken into account. Figure and caption revised. (double-check after revision of figure 2)
18163	1	17	14	17	15	In the timeline of a world withut effective responses, there is a "decision point" marker with no lines coming out of it. What is this meant to imply? Are there no viable sustainable decisions? In which case... does that society collapse? It's not clear, and I think the meaning should be indicted in the figure or mentioned in the caption, or else the dead-end decision point should be omitted. [APECS Group Review, Germany]	Taken into account. Figure revised
26923	1	17	14	17	15	Is there any basis for the Figrue, or just hypothetical? Though looks [Golam Rasul, Nepal]	Taken into account. Figure and caption was revised.
28327	1	17	14	17	15	the sentence "opportunity for sustainable development" should read in bold, I would suggest to re-arrance the right part by moving this sentence to the top in the area after time line, and to just write "limited" and "enhanced", may be "more and more limited"... [Anne GUILLAUME, France]	Taken into account. Figure text was revised.
32351	1	17	14	17	19	The illustration of what adaptive management will deliver is simplistic and does not necessarily deliver the range of sustainable development options. A difficulty with this box overall is that it is devolving governance to the level of the individual and fragmenting what will need to be an adaptive regulatory framework. The outcome needs to be one where the global environment (social, economic, natural systems) is within satisfactory boundaries. Climate change has an emphasis on natural systems with consequent effects on social and economic systems. How to keep the natural system within satisfactory bounds and keeping the disruption (and avoidance of disruption) of social and economic systems within satisfactory bounds will be the aim of the governance framework. This figure does not help convey that message. [Andrew Constable, Australia]	Taken into accounte -- Thank you for these valuable comments. The text has been revised to strenghten the cross-refrerences to the Cross Chapter Box on governance with addresses these points in detail.
1313	1	17	15	0		This illustration is not helpful enough to take up this much space. I would delete it entirely. If modified, I would suggest changing the picture meant to indicate decision points, because it currently looks like a multi-generational family tree. [Jacinta Clay, United States of America]	Taken into account. Figure revised and merged with figure 2.
16475	1	17	15	17	15	does this Figure really tell more than AR5 WG2 Fig. SPM.9? [Georg Kaser, Austria]	Taken into account. Figure revised and reference to SPM.9 of AR5 added in caption.
22445	1	17	15	17	15	Suggest removing one of the two versions of the same panel in this figure, as both may not be warranted. [Government of Australia, Australia]	Taken into account. Figure revised.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
3485	1	17	15	17	20	In cross-chapter box 1, I believe that figure 3 could be enhanced. The visualization of the content is interesting; however, I believe it could be further developed to add more than what is stated rather simply in the text already. To add value to the figure, I would suggest the addition of a few key ideas. (1) In the figure, change "decision points" to "adatpation decision points." (2) Extend the figure to the right… What happens when the opportunity space for sustainable development is smaller or larger? For example, does it increase the likelihood of succeeding with the sustainable development goals? Does it decrease the likelihood of "successfully" adapting to climate change? I expect that extending the thought processes into the implications of these smaller and larger opportunity spaces would increase the intrinsic value of the figure as well as increase likelihood of citing the figure. [Katherine Bishop-Williams, Canada]	Taken into account. The figure has experience a major revision in line with these and other review comments. Due to space restrictions, not all suggestions could be fully implemented.
1315	1	17	22	0	23	"transformations (see SROCC Annex I: Glossary)" could be shortened to just "changes" or "societal changes" [Jacinta Clay, United States of America]	Accepted. Text shortened.
23013	1	18	0	19		references to be moved to the end of the chapter with the others and not just for the x chapter box (as done in SR15) [Valerie Masson-Delmotte, France]	Accepted. References moved to the end of the chapter.
5589	1	18	2	18	2	The concept of "acceptable level is introduced in the box. This begs the question to whom?And this raises the question of future generations. The text seems to imply current generations values and preferences will prevail in reducing risks. Public agencies are set up to address the needs of future generations. This does not appear to have been considered in the framing chapter and it is fundamental for how we make decisions today. Could this issue be addressed in several approproate places in this framing chapter to have the future well embedded in the text and to recognise uncertainties that will never be resolved before decisions are taken. [Judy Lawrence, New Zealand]	Taken into account: discussion of future has been revised.
8727	1	18	5	0		A semi-colon needs to come before 'some' instead of a bracket. [Nina Hunter, South Africa]	Accepted. Use of bracket is corrected.
16665	1	18	5	18	6	There are issues with parentheses. [Samuel Morin, France]	Accepted. Text revised.
1317	1	18	7	0	9	I find these phrases jargony. "Examples of possible societal transformation related to the ocean and cryosphere include supporting residents of coastal megacities by relocating them inland instead of laying artificial beach or moving agriculture away from regions soon to lose glacier water" or something like this. [Jacinta Clay, United States of America]	Accepted. Text revised for clarity.
1319	1	18	10	0	12	I find this last sentence redundant and a little too long. Also I feel like it merits more citations. I would suggest shortening it to "Transdisciplinary collaboration between science, government, the private sector, civil society, and affected communities (Section 1.8.3 and Cross-Chapter Box 3), can foster transformation in different ocean and cryosphere contexts (Padmanabhan, 2017; Cross-Chapter Box 2). " [Jacinta Clay, United States of America]	Accepted. Text revised according to suggestion.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4041	1	20	15	20	15	Page 2-20 Line 15: suggest to add “For extensive distribution of lakes on the Tibetan Plateau, shorter lake ice durations, i.e. later freeze-up and earlier break-up dates are driven by warmer lake surface temperature (Zhang et al., 2014).” References: Zhang, G., T. Yao, H. Xie, J. Qin, Q. Ye, Y. Dai, and R. Guo (2014), Estimating surface temperature changes of lakes in the Tibetan Plateau using MODIS LST data, Journal of Geophysical Research: Atmospheres, 119(14), 8552−8567, doi: 10.1002/2014JD021615 [Fan Zhang, China]	Taken into account -- Thank you for these valuable comments and suggestions. However, due to space restrictions the addition of further examplas has proven not feasible.
11181	1	20	22	20	22	I find the usage of „tipping point“ confusing. I suggest to use „threshold“ instead. [Dirk Notz, Germany]	Accepted. Text revised.
27135	1	20	26	21	48	It seems that the risk concept applied in this section is not aligned well with the risk definition used internationally. It should be carefully checked. [XIAOMING WANG, Australia]	Noted. This section, as well as the associated glossary terms, have been revised, and the use of these terms is now internally consistent within SROCC.
1321	1	20	28	0	30	Natural systems should be lowercased. [Jacinta Clay, United States of America]	Accepted.
18187	1	20	28	20	28	Presumably also 'chemical'. For example, the first three hazards mentioned include oceanic deoxygenation and acidification. [APECS Group Review, Germany]	The Glossary definition does not include chemical so we were not allowed to specifically add it, but it is assumed that physical and biological includes chemical.
11379	1	20	28	20	32	There are several ambiguities in this paragraph. Firstly, does the term "natural system" also represent the chemical components of the environment (e.g. nutrient fluxes such as nitrogen, carbon)? Secondly, I think ocean upwelling system might not be the best example of a physical system because nutrient fluxes can also be considered in the system without considering organisms. Broader systems like ocean circulation might be a better example for a physical system. Lastly, it is not clear to me how a pristine system is defined. [Anson Cheung, United States of America]	Accepted. The full sentence was altered to clarify ambiguities and make clear it applied to the full assessment, not just one chapter. We have elected to keep "upwelling system" but acknowledge that there are many possible alternatives.
28329	1	20	31	20	31	I do not understand what is meant by "pristine" and why it matters to say that here. [Anne GUILLAUME, France]	Noted. We have revised the text to be more specific about what is included in the SROCC report. In previous versions of this chapter there have been questions and comments about whether a "natural" system implies pristine, so the text is written to clarify that natural systems do not necessarily mean those systems are pristine.
11381	1	20	34	20	49	Only marine ecosystem (biological component) is discussed in this section. However, according to previous paragraph, natural system is used to described the physical and/or biological components of the environment. So technically this contradicts the definition made in the previous paragraph. [Anson Cheung, United States of America]	Noted. The text now includes deoxygenation and acidification (chemical), and changes to habitat features of reefs, beaches, pelagic and seamounts (physical and chemical) as well biological responses ot those changes.
27123	1	20	36	20	37	Are they hazards or consequences of climate change? [XIAOMING WANG, Australia]	Noted. The use of hazards is consistent with the definitions of risk-related terms in SROCC, but we acknowledge these are also consequences of climate change.
4265	1	20	37	20	37	while here OA is considered a "hazard", later on (p.21l.16-17) is considered to be "exposure", which again links to my comment on the confusing nature of the propeller figure in page 14 [Manuel Barange, Italy]	Noted. The use of hazards is consistent with the definitions of risk-related terms in SROCC, but we acknowledge these are also consequences of climate change.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4263	1	20	37	20	38	I do not agree that shifts in ranges of fish are hazards. Shifts are both positive and negative and hazard does not convey that dual view. [Manuel Barange, Italy]	Noted. The subheading has been modified to read "hazards and opportunities", and shifts are described as documented without implying that these shifts are positive or negative, except in specific context.
13755	1	20	43	20	45	Text notes that climate warming may lead to habitat expansion, in addition to shifts in ecosystem/organism ranges and phenology. It would also be helpful to note that for some habitats (e.g. high mountain areas) habitat range will decrease. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text in this section was modified to include habitat expansion, contraction, range-shifts, and changes in phenology.
26827	1	20	47	0	49	What about non-linear effects referenced earlier in the chapter? Maybe add a qualifier…generally? [Ko Barrett, United States of America]	Accepted.
13757	1	20	47	20	47	Ecosystem services' is this term clearly set out and defined somewhere? It might aid the reader if a brief description was provided on first use here. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted. The terms is defined in the Glossary, and its use is consistent with UN-scale assessments such as MEA and IPBES.
3407	1	20	47	20	49	What is the significance of this statement? Seems to be a duplicate of many other sentences throughout the report. [Patrick Orenstein, United States of America]	Noted. This statement is intended to frame the narrative and link the text to specific terminology used by IPCC. It was also highlighted by other reviewers as a particularly important statement.
27125	1	20	48	20	48	Is it risk or likelihood? It seems to be intended to illustrate the hazards to natural systems in this section, but not exactly. Risk is a combination of likelihood and consequence, the consequences are considered as impacts given a hazard event. The use of "risk of impact" is confusing. [XIAOMING WANG, Australia]	Accepted. The language was adjusted to align with the definitions of risk and consequences.
27127	1	20	53	20	53	This should be 'exposure to hazards'. Exposure is one of three key elements in analysing risks. [XIAOMING WANG, Australia]	Accepted.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17499	1	20	54	20	58	Add that teleconnections impact of altering weather patterns and persistence of extreme events. Francis J. A. & Vavrus S. J. (2015) Evidence for a wavier jet stream in response to rapid Arctic warming, ENVTL. RESEARCH LETTERS 10(014005):1–12; Francis J. A. & Vavrus S. J. (2012) Evidence linking Arctic amplification to extreme weather in mid-latitudes, GEOPHYSICAL RESEARCH LETTERS 39(L06801):1–6; Screen J. A. & Simmonds I. (2013) Exploring links between Arctic amplification and mid-latitude weather, GEOPHYSICAL RESEARCH LETTERS 40:959–964; Cohen J., et al. (2018) Warm Arctic episodes linked with increased frequency of extreme winter weather in the United States, NATURE COMMUNICATIONS 9(869):1–12; Cvijanovic I., et al. (2017) Future loss of Arctic sea-ice cover could drive a substantial decrease in California's rainfall, NATURE COMMUNICATIONS 8(1947):1–10. [Kristin Campbell, United States of America]	Noted. The term was added explicitly in what we consider to be a slightly more appropriate location in this section.
17599	1	20	54	20	58	Add that teleconnections impact of altering weather patterns and persistence of extreme events. Francis J. A. & Vavrus S. J. (2015) Evidence for a wavier jet stream in response to rapid Arctic warming, ENVTL. RESEARCH LETTERS 10(014005):1–12; Francis J. A. & Vavrus S. J. (2012) Evidence linking Arctic amplification to extreme weather in mid-latitudes, GEOPHYSICAL RESEARCH LETTERS 39(L06801):1–6; Screen J. A. & Simmonds I. (2013) Exploring links between Arctic amplification and mid-latitude weather, GEOPHYSICAL RESEARCH LETTERS 40:959–964; Cohen J., et al. (2018) Warm Arctic episodes linked with increased frequency of extreme winter weather in the United States, NATURE COMMUNICATIONS 9(869):1–12; Cvijanovic I., et al. (2017) Future loss of Arctic sea-ice cover could drive a substantial decrease in California's rainfall, NATURE COMMUNICATIONS 8(1947):1–10. [Durwood Zaelke, United States of America]	Noted. See also comment #730.
17601	1	20	54	20	58	Loss of Arctic sea ice is estimated to occur within 15 years, according to Overland and Wang (2013) When will the summer Arctic be nearly sea ice free?, GEOPHYSICAL RESEARCH LETTERS 40:2097–2101, 2097 ("Time horizons for a nearly sea ice-free summer for these three approaches [for estimating future ice loss covered in the study] are roughly 2020 or earlier, 2030 ± 10 years, and 2040 or later."). Also, note the implications of increased climate forcing from reduced Arctic sea ice, which will be more extreme as less and less ice exists in the Arctic; see Pistone K., et al. (2014) Observational Determination of Albedo Decrease Caused by Vanishing Arctic Sea Ice, PROC. NAT'L. ACAD. SCI. 111(9):3322–3326. [Durwood Zaelke, United States of America]	Noted. We consider specific factual information to be better placed in Chapter 2 (so we don't simply duplicate the assessment conducted by that chapter).

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27499	1	20	54	20	58	The direct link between declining Arctic sea ice and ice sheet melt rates is possibly a bit overstated here. There are fairly convincing but largely local effects especially in the Stroeve paper - but other analyses have shown relatively small distal effects, for example Pedersen et al., JClim 2016; https://doi.org/10.1175/JCLI-D-15-0315.1 The effect of declining sea ice and enhanced ice sheet melt seem to be more co-causal - related to blocking highs for example. Screen J Clim 2017 https://doi.org/10.1175/JCLI-D-16-0197.1 also comes to a similar conclusion that the response is more nuanced and complex. [Ruth Mottram, Denmark]	Noted. This sentence was modified to include the adjective "locally".
21587	1	21	5	21	5	The reference to Phillips et al., 2017 concerns hazards (and in a narrow case-specific way) not climate. [Stephan Gruber, Canada]	Noted. Climate change as a hazard is consistent with the usage in the Phillips reference.
1327	1	21	8	0	21	These two paragraphs can be condensed into one paragraph [Jacinta Clay, United States of America]	Accepted.
29897	1	21	8	21	14	add something on interactions among these stressors [Anna Zivian, United States of America]	Noted. This section was restructured, and now includes reference to aggregrate risk from multiple drivers.
538	1	21	8	21	21	These two paragraphs seem a bit redudant, and the wording could use some revision. Perhaps they could be combined into one. [Jenna Pearson, United States of America]	Accepted. The paragraphs were combined and reorganized to maintain a logical flow.
1895	1	21	8	21	8	Exposure to climate change risk? Exposure determines risk according to the risk framing outlined in the Box. So it should be exposure to climate change (hazards). [Jana Sillmann, Norway]	Accepted.
27129	1	21	8	21	8	Again, it should be exposure to climate change hazards, instead of climate change risk [XIAOMING WANG, Australia]	Accepted.
1325	1	21	12	0	14	I'm a ocean scientist and I don't know what "multi-driver" impacts would refer to. Additionally, I think an example of how ocean deoxygenation/ acidification impact marine organisms would be beneficial to the scientific and general audience. The following 2013+ articles may be worth citing: deoxygenation http://rsbl.royalsocietypublishing.org/content/11/2/20141032, http://science.sciencemag.org/content/359/6371/eaam7240, https://www.frontiersin.org/articles/10.3389/fmars.2016.00062/full https://link.springer.com/article/10.1007/s40641-015-0008-4, acidification https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.12179, https://www.nature.com/articles/nclimate2479, https://onlinelibrary.wiley.com/doi/abs/10.1111/raq.12140, https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.12833 [Jacinta Clay, United States of America]	Accepted. The wording was modfied to be more clear about what was meant. Two of the references are included in the revised text, and we note that subsequent chapters deal more completely with the literature since AR5.
1891	1	21	16	21	16	There is a typo in "Increasing exposure to climate change risk exposure"..delete one "exposure" [Jana Sillmann, Norway]	Accepted. The text has been modified.
4267	1	21	16	21	16	"increasing exposure to climate change risk exposure in open natural systems…" seems linguistically challenging [Manuel Barange, Italy]	Accepted. The text has been modified.
27131	1	21	16	21	16	increasing exposure to climate risk exposure', what does it mean? [XIAOMING WANG, Australia]	Accepted. The text has been modified.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4337	1	21	20	21	21	Why this particular model bias is highlighted? We could highlight several model biases related to other variables too. [The UBern Team Group Review, Switzerland]	Accepted. More general language was added.
1329	1	21	25	0		The word "lead" conveys that vulnerability is an active factor. Perhaps "threatens" or "jeopardizes" would be more appropriate. Alternatively, the paragraph might make more sense if the beginning clause is deleted: "About half of species assessed on the northeast United States continental shelf exhibited high to very high climate vulnerability (Hare et al., 2016), with corresponding …" [Jacinta Clay, United States of America]	Accepted. The sentence was reorganised and the phrasing was altered.
1893	1	21	25	21	25	Vulnerabilities to risk? Vulnerability determines risk according to the risk framing outlined in the Box. So it should be vulnerabilty to climate change (hazards). [Jana Sillmann, Norway]	Accepted. The sentence was reorganised and the phrasing was altered.
27133	1	21	25	21	25	Vulnerability to risk', what does it mean? [XIAOMING WANG, Australia]	Accepted. The sentence was reorganised and the phrasing was altered.
30535	1	21	25	21	26	Please be more explicit, is this due to physiological characteristics or other aspects? [Hans-Otto Poertner and WGII TSU, Germany]	Noted. It is rarely established if the temperature preferences are solely physiological tolerances or also behavioural preferences, so a neutral wording is chosen.
1331	1	21	29	0		There should be a citation after "Vulnerability may manifest where organisms or ecosystems are unable to migrate or evolve at the rate required to adapt to ocean and cryosphere changes". Potentially it could be one of the six citations that end the paragraph, which would make the paragraph as a whole more balanced. [Jacinta Clay, United States of America]	Accepted. A reference to Miller et al. 2018 (a meta-analysis) has been added.
1333	1	21	29	0	30	There should be citations after this sentence as well. [Jacinta Clay, United States of America]	Accepted. This section was rewritten, and references are included.
1335	1	21	30	0	31	Are the examples referred to examples of criteria described in both previous sentences or only the immediately previous sentence. It is unclear. If it's the previous sentence only, this sentence should be annexed into the previous using "such as" or a similar term. [Jacinta Clay, United States of America]	Accepted.
1337	1	21	31	0		"including plastics pollution " is redundant. Delete it. [Jacinta Clay, United States of America]	Noted. However, other reviewers specifically requested that plastics be included.
28331	1	21	31	21	32	Why isn't "transport and shipping" in this list? [Anne GUILLAUME, France]	Noted. This is an illustrative list and given space constraints we could not include all examples.
1339	1	21	34	0		Framework should be plural [Jacinta Clay, United States of America]	Accepted.
29899	1	21	34	21	48	perhaps a Clive Spash reference? E.g., https://www.sciencedirect.com/science/article/pii/S0301479715300384 [Anna Zivian, United States of America]	Noted, but given the space constraints this reference was considered to be secondary to MEA and IPBES references
9479	1	21	36	21	39	We suggest to replace « mental health » by « health » in general. [Government of France, France]	Accepted.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18147	1	21	36	21	48	E1a: The introduction of the different frameworks is kind of abrupt, for someone that doesn't know about that subject (me) it is confusing, although at the end of the paragraph what they are used for is clarified. I think the readability of this paragaph would gain from rephrasing it, maybe changing the orther of the sentences. [APECS Group Review, Germany]	Accepted. The sentences were restructured.
26829	1	21	40	0	42	The message of this sentence is not clear as written. [Ko Barrett, United States of America]	Noted. The sentence was rewritten (see also comment # 760)
8729	1	21	41	0		Consider replacing 'criticised for' with 'challenged as'. [Nina Hunter, South Africa]	Accepted
11633	1	21	41	21	41	It is a common misunderstanding among non-economist to interpret value as price, even if it is represented by a monetary unit it is the value or utility that a person wiht a given monetary restriction gives to a good. Portraying this kind of theoretical discussion dims the relevance of the report [Government of Mexico, Mexico]	Accepted. Value is not identical to price. The former is determined by preferences/utility, the latter by market exchange. The sentence citing Diaz mixes both. "monetizing the relationships of people with nature" has been deleted. What is left is “The ecosystem services framework has been criticized to undervalue small-scale livelihoods, cultural values and other considerations that contribute little to global commerce (Díaz et al., 2018).”
1341	1	21	52	0		*the 'human system' or *'human systems' [Jacinta Clay, United States of America]	Accepted. Text revised.
3487	1	21	53	21	57	The statement of reliance on the ocean and crosphere for millenia seems both reasonable and plausible, yet the citations currently provided are relatively unconvincing. Utilizing a few additional references in each place may strengthen the argument. In particular, the third and fourth placeholders for citations in these sentences provide only one citation each. Further, the third citation is rather dated (i.e. 1999). I imagine there is much more literature that supports these points. [Katherine Bishop-Williams, Canada]	Accepted. Additional references added.
18149	1	21	54	21	54	E2: Kubiszewski et al. (2017) does not refer to what is indicated in the text. [APECS Group Review, Germany]	Accepted. Reference removed.
23015	1	21	57	21	57	"proportionally greated" : please provide more substance to this description. Proportionally greater than what? [Valerie Masson-Delmotte, France]	Accepted. Text revised.
25747	1	22	0	0		Reference to Indian tropical cyclones in the recent past may be added [Government of India, India]	Taken into account throughout Chapter 4.
17279	1	22	4	22	4	This is a great paragraph but would suggest at the outset here changing 'wellbeing and security' to 'health, wellbeing, safety, and security' to be more complete - it is important to note that environmental changes impact all aspects of health (physical, mental) and have direct impact on safety (eg. Risk of falling through ice has dramatically increased in the Arctic). [Joanna MacDonald, Canada]	Accepted. Text revised accordingly.
2809	1	22	5	22	6	It is recommended to supplement mountain glacial disasters that have caused huge disasters and are likely to occur frequently in the future, such as glacier collapse/surge and glacial lake outburst floods (GLOF). This part can be placed in Chapter 2: High Mountain Areas or Chapter 6: Extremes, Abrupt Changes and Managing Risks. [Feiteng Wang, China]	Accepted. Example added.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18189	1	22	7	22	7	It would be worth including that rising ocean temperatures in the midlatitudes have also been linked to poleward migration of tropical cyclones (e.g. Studholme and Gulev, 2018: Concurrent Changes to Hadley Circulation and the Meridional Distribution of Tropical Cyclones. Journal of Climate 31(11), 4367-4389.) [APECS Group Review, Germany]	Taken into account: text revised to remove cyclones.
23017	1	22	8	22	8	Wrong reference to AR5 on cyclones. The conclusion in the observation chanter is "In summary, this assessment does not revise the SREX conclusion of low confidence that any reported long-term (centennial) increases in tropical cyclone activity are robust, after accounting for past changes in observing capabilities. More recent assessments indicate that it is unlikely that annual numbers of tropical storms, hurricanes and major hurricanes counts have increased over the past 100 years in the North Atlantic basin. Evidence, however, is for a virtually certain increase in the frequency and intensity of the strongest tropical cyclones since the 1970s in that region.". So outside the Atlantic basin no conclusion on changes in wind or precipitation. [Valerie Masson-Delmotte, France]	Accepted. Text revised and cyclone was removed.
17501	1	22	12	22	21	Reduced Arctic sea ice allows greater swell of waves in the Arctic Ocean, which can further disrupt sea ice and accelerate breaking up of ice, becoming a positive feedback loop; see Thomson J. & Rogers W. E. (2014) Swell and sea in the emerging Arctic Ocean, GEOPHYSICAL RESEARCH LETTERS 41:3136–3140. At the same time, reduced sea ice provides favorable conditions for cyclone development and increased intensity of cyclones, which can also facilitate break-up of sea ice; see Day J. J. & Hodges K. I. (2018) Growing Land-Sea Temperature Contrast and the Intensification of Arctic Cyclones, GEOPHYSICAL RESEARCH LETTERS 45:3673–3681. [Kristin Campbell, United States of America]	Taken into account. Text revised to include swell and sea.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17603	1	22	12	22	21	Reduced Arctic sea ice allows greater swell of waves in the Arctic Ocean, which can further disrupt sea ice and accelerate breaking up of ice, becoming a positive feedback loop; see Thomson J. & Rogers W. E. (2014) Swell and sea in the emerging Arctic Ocean, GEOPHYSICAL RESEARCH LETTERS 41:3136–3140, 3136 (“Ocean surface waves (sea and swell) are generated by winds blowing over a distance (fetch) for a duration of time. In the Arctic Ocean, fetch varies seasonally from essentially zero in winter to hundreds of kilometers in recent summers. Using in situ observations of waves in the central Beaufort Sea, combined with a numerical wave model and satellite sea ice observations, we show that wave energy scales with fetch throughout the seasonal ice cycle. Furthermore, we show that the increased open water of 2012 allowed waves to develop beyond pure wind seas and evolve into swells. The swells remain tied to the available fetch, however, because fetch is a proxy for the basin size in which the wave evolution occurs. Thus, both sea and swell depend on the open water fetch in the Arctic, because the swell is regionally driven. This suggests that further reductions in seasonal ice cover in the future will result in larger waves, which in turn provide a mechanism to break up sea ice and accelerate ice retreat.”). At the same time, reduced sea ice provides favorable conditions for cyclone development and increased intensity of cyclones, which can also facilitate break-up of sea ice; see Day J. J. & Hodges K. I. (2018) Growing Land-Sea Temperature Contrast and the Intensification of Arctic Cyclones, GEOPHYSICAL RESEARCH LETTERS 45:3673–3681, 3680 (“Further, because climate change is increasing land-sea contrasts in the Arctic, it seems highly likely that the circulation patterns typical of years with strong AFZ will become more common as the climate warms. Indeed, strengthening of the mean temperature gradients in the AFZ is a robust feature of future climate projections as is an increase in the strength of the Arctic Front Jet (Mann et al., 2017; Nishii et al., 2014). This study shows that this linkage between surface temperature gradients and atmospheric circulation is important for Arctic cyclones, adding weight to previous studies.”). [Durwood Zaelke, United States of America]	Taken into account. Text revised to include swell and sea.
2813	1	22	14	22	15	For example, thawing permafrost and sea level rise has damaged Arctic infrastructure (e.g., buildings, roads) (AMAP, 2015; AMAP, 2017). [Suggestion to add a citation] [Kazuyuki Saito, Japan]	Accepted. Reference added.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1343	1	22	20	0		It's unclear to me whether the tipping point in question refers to the ability of Northern people to subsist given climate, or the tipping point refers to a climate change so significant that a threshold has been reached. I interpreted the phrase as if the tipping point referred to the climate, and I have an issue with the sea ice reference. Since sea ice experiences little to no hysteresis, describing the incremental loss of sea ice and permafrost as reaching a tipping point would be a poor scientific claim. The global/polar environmental has reached a tipping point, which is characterized by a lack of sea ice and permafrost melting. Perhaps this should be phrased "The polar environment has reached a tipping point. Predictions indicate arctic summer sea ice will cease entirely and the practices of Inuit and other Northern cultures dependent on sea ice stability and ecoystems will be unable to adapt." [Jacinta Clay, United States of America]	Accepted. The sentence has been modified and no longer focuses on sea ice.
22193	1	22	20	22	21	"...the seemingly incremental loss of sea ice thickness..." Again, as for the above point (page 12, lines 11 to 12), coordination between the authors of Chapter 1, 3 and the Integrative Cross-Chapter Box 7 is needed on how to describe the speed of these changes. [Inga Smith, New Zealand]	Accepted. Text revised and no longer focuses on sea ice.
1897	1	22	22	22	23	"Climate change impacts on the ocean and cryosphere also present opportunities, in at least the near and medium term" contradtics definition of "impacts" in SROCC glossary. [Jana Sillmann, Norway]	Taken into account in Glossary. "Impacts" can refer to "beneficial" impacts.
1345	1	22	23	0	24	*near- and medium-term. [Jacinta Clay, United States of America]	Accepted. Editorial - copy-edit to be completed prior to publication.
15429	1	22	23	22	23	When considering opportunities opened up by climate change, perhaps it would be important to recall also that these opportunities sometimes represent trade-offs with mitigation or other SDGs, e.g. shipping routes are overall bad news for biodiviersity, marine pollution and black carbon over remaining ice. [EUCE, Belgium]	Accepted. The concept of trade-offs is now introduced in the text and the text is revised.
11619	1	22	23	22	24	It would be interesting estimate the benefits-costs between hazards and opportunities associated on possible ocean and cryosphere changes. [Government of Mexico, Mexico]	Accepted. The concept of trade-offs is now introduced in the text.
17503	1	22	23	22	27	The opportunities of both increased shipping and access to mineral resources is an incredibly short-sighted opportunity. Shipping increases localized pollution, including increases in black carbon deposition that can be especially detrimental to ice surfaces by way of reducing albedo. There are also safety concerns with any activities in the Arctic, many of which we are not presently prepared. Stephenson S. R., et al. (2018) Climatic responses to future trans-Arctic shipping, GEOPHYSICAL RESEARCH LETTERS 45:9898–9908; Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA; Arctic Council Secretariat (2017) EXPERT GROUP ON BLACK CARBON AND METHANE: SUMMARY OF PROGRESS AND RECOMMENDATIONS 2017. [Kristin Campbell, United States of America]	Taken into account. Text removed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17605	1	22	23	22	27	The opportunities of both increased shipping and access to mineral resources is an incredibly short-sighted opportunity. Must emphasize that the risks and additional climate impacts far outweigh the benefits that may be gained from shipping, tourism, or other transit through the Arctic. Shipping increases localized pollution, including increases in black carbon deposition that can be especially detrimental to ice surfaces by way of reducing albedo. There are also safety concerns with any activities in the Arctic, many of which we are not presently prepared. Stephenson S. R., et al. (2018) Climatic responses to future trans-Arctic shipping, GEOPHYSICAL RESEARCH LETTERS 45:9898–9908, 9898 ("Because warming favors increased shipping traffic, previous studies have focused on the potential for ship emissions of black carbon (BC) and other particulates to enhance warming by lowering the otherwise high albedo of ice and snow (Browse et al., 2013; Corbett et al., 2010; Ødemark et al., 2012; Sand et al., 2016). The source of emissions is an important factor in determining the magnitude of this feedback and their ultimate climatic impact. Unlike BC transported to the Arctic from these midlatitude sources in Russia and Asia (Winiger et al., 2017; Wobus et al., 2016), strong surface inversions in the Arctic boundary layer make it more likely that BC emitted in the Arctic will be deposited on ice and snow, thereby maximizing its impact on surface temperature."); Arctic Monitoring and Assessment Programme (AMAP) (2017) ADAPTATION ACTIONS FOR A CHANGING ARCTIC: PERSPECTIVES FROM THE BARENTS AREA, 1 ("Changes in climate will have direct impacts on snow and ice, as well as on terrestrial, freshwater and marine ecosystems. In addition to climate change, the region's ecosystems are also influenced by several other impacts of human activities, such as chemical pollution, invasive species, and increased shipping and industrial developments. The end result is cumulative and cascading impacts on ecosystems and societies in the area."); Arctic Council Secretariat (2017) EXPERT GROUP ON BLACK CARBON AND METHANE: SUMMARY OF PROGRESS AND RECOMMENDATIONS 2017, 17 ("Arctic shipping currently accounts for about 5 percent of black carbon emissions within the Arctic; absent emission controls, shipping emissions within the Arctic could double by 2030 under some projections of Arctic vessel traffic."). [Durwood Zaelke, United States of America]	Taken into account. Text is now removed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17281	1	22	23	22	33	This is an important section about the potential opportunities from climate-related changes but it should be simultaneously noted that "taking advantage" of opportunities must be grounded in priorities of the population in question. Particularly in the Arctic, the opening of shipping routes directly implicates the Indigenous communities in this region and as such if this is listed as an opportunity, it should be clearly noted that this perspective is dependent on the priorities of the Indigenous communities and in discussing the possibility to "gain from new opportunities" it should be made very clear in terms of WHO is gaining - is it Arctic inhabitants or is it shipping companies who now have a shorter route? So not only is it necessary to be informed about what is coming in the future (as the end of the paragraph notes), but it is also necessary to consider local priorities, local perspectives, and local context because opportunities are subjective and the ability to gain from them is dependent on having the resources and infrastructure to do so. Without acknowledging this, the paragraph is lacking significant and important recognition and respect for Indigenous rights. [Joanna MacDonald, Canada]	Accepted. The concept of who is benefitting has been added. The text about shipping has been removed.
32185	1	22	23	22	33	It can be better framed in terms of risks (adverse effect) and services (positive effect) that ocean and cryosphere may all cause or provide. More information can be obtained from a submitted paper of the reviewer. [XIAOMING WANG, Australia]	Taken into consideration. Text edited to align with the Glossary.
26831	1	22	25	0		Why local and what does local mean in this case? Are there non-local farmers? Better to say some farmers. [Ko Barrett, United States of America]	Accepted. Text revised.
13759	1	22	26	22	27	It would be useful to link this with information on how changes may also affect climate further, e.g. black carbon on ice/snow. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text related to the Arctic in this instance was removed.
1347	1	22	27	0	29	This sentence can be shortened: "Rising ocean temperatures redistribute the global fish population, allowing new fishing opportunities." There should also be a citation. [Jacinta Clay, United States of America]	Accepted. Text revised.
4269	1	22	27	22	28	The text of "...marine fishing opportunities are changing..." appears to be referring to the Arctic (see previous sentence), but the reference in support is from the equatorial Pacific, and indeed the text could apply to any ocean region, not just Arctic [Manuel Barange, Italy]	Accepted. Text about the Arctic was removed in this instance.
11621	1	22	27	22	29	About redistribution of marine fish, this has a higher associated uncertainty. We unknown the new migration patterns and distribution areas of the marine life. In addition there are a legal topic associated to permissions, territorial sea and economic exclusive zones that are not contemplate. [Government of Mexico, Mexico]	Taken into consideration. Text revised for clarity. Comment taken into account in Chapter 5.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1349	1	22	29	0	33	These sentences can be deleted entirely. [Jacinta Clay, United States of America]	Accepted. Text removed.
25923	1	22	32	22	33	Example where text can be more streamlined to avoid repetition. This sentence (with some variation) is true for all sections of chapter 1, why just here in 1.5.2.1. Looks like sections were not homogenized in writing style. Other examples are page 25, 28-29, or page 26, L50-51. [Regine Hock, United States of America]	Accepted. Text revised.
32433	1	22	35	22	35	Human system (in fact, also natural system) could be exposed to, not only hazards, but also the deterioration of services that ocean and cryosphere have been providing. It should be reflected in this section. [XIAOMING WANG, Australia]	Accepted. Text revised to integrate concept of deteriotation of ecosystem services.
5591	1	22	35	22	44	This text does not acknowledge that institutions and governance are human systems and that they are critical for building adaptive capacity to address the impacts of climate change and their interdependencies. [Judy Lawrence, New Zealand]	Taken into account in Section 1.6.2 and 1.5.3.
17027	1	22	37	0		maybe it is necessary to include a table with the environmental hazards, type (only meteorology (like storm), hydrometeorology, only hydrologcal (GLOF)), projections, etc, that are associeted with risk and impacts [Jorge Carrasco, Chile]	Noted. The specific hazards are identified in more detail in the subsequent chapters. As a the framing chapter we deliberately provide examples but not exhaustive lists to avoid signficant overlap or contradictions with the details in the assessment chapters. There are also space constraints on the chapter length that require us to abbreviate much of the potential content, such as the suggested table.
11635	1	22	40	22	40	Add "proliferation of vectors" [Government of Mexico, Mexico]	Accepted. Text added.
26833	1	22	41	0		How does exposure to climate hazards contribute to mental health challenges? Not intuitive. [Ko Barrett, United States of America]	Accepted. Text added for clarity and reference is included.
16667	1	22	51	22	51	Missing reference to section 2.3.3, 2.3.4, 2.3.5 [Samuel Morin, France]	Accepted. Cross-references added.
25925	1	22	54	22	54	It would be better to remove the references and only refer to the section where the propoer references can be found. Here the selection seems random. There are many such examples throughout chapter 1. The problem would disappear if - as suggested earlier sections 1.4-1.5 are greatly reduced and largely avoid repetiting chapter content. [Regine Hock, United States of America]	Accepted. References removed.
16669	1	22	55	22	55	Reference to section 2.3.4 to be expanded to 2.3.4 and 2.3.5 and 2.3.6 [Samuel Morin, France]	Accepted. Cross-references added.
22195	1	23	1	23	2	"...livelihoods, habitability, food security, transportation, culture, health and well-being" Again, as for the point on page 7, line 30-35 of this chapter, so agreed text is needed that aligns with Integrative Cross-Chapter Box 7 (and Chapter 3). [Inga Smith, New Zealand]	Accepted. Text modified accordingly.
23019	1	23	4	23	13	Concept of solastagia could be introduced here. [Valerie Masson-Delmotte, France]	Taken into account in Section 1.8.3
30501	1	23	4	23	13	Refer to CCB7 LLIC somewhere in this paragraph [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. Cross-references added.
16671	1	23	4	23	5	The acronym LECZ is defined and then only used once in the chapter, in the following line. This is a good example of a useless acronym, which could/should be removed. [Samuel Morin, France]	Accepted. Acronym has been removed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25927	1	23	4	23	5	remove "LECZ". Avoid acronyms. This only occurs twices within the same 2 lines and in the secod case can be reformulated to "Population in these zones ..." [Regine Hock, United States of America]	Accepted. Acronym has been removed. Text has been revised.
32849	1	23	6	23	6	This line is not policy-neutral. Suggest rephrasing to read: "Rapid and effective actions to mitigate GHG emissions would be required to meet the goals of the Paris Agreement ..." [Government of United States of America, United States of America]	The reviewer actually refers to line 46. Accepted. The text has been modified accordingly.
32467	1	23	15	23	15	Human system (in fact, also natural system) could be vulnerable to, not only hazards, but also the deterioration of services that ocean and cryosphere have been providing. It should also be reflected in this section. [XIAOMING WANG, Australia]	Accepted. The text was modified to include this point.
13761	1	23	15	23	41	this is quite a general discussion. Either cut down or relate it more explicitly to oceans and cryosphere. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Reference to oceans and cryosphere was added and text was shortened.
3489	1	23	16	23	28	There is plenty of evidence that supports the claims made in the first half of this paragraph; however, citations are reltatively lacking in this paragraph. Perhaps even a reference to AR5 (WG II, Chapter 11) or the SR on Extreme Events would help to strengthen these statements. [Katherine Bishop-Williams, Canada]	Accepted. Cross-references to other chapters have been added. References have been added. Reference to AR5 is included.
28081	1	23	17	23	22	This is well stated. A possible addition to this section is a note that vulnerabilities and inequalities also may have historical depth. Such time depth can make addressing vulnerabilities particularly difficult as communities have developed correspondingly different access to resources and information, different identities, and perceptions of and responses to risk. A reference for this concept is: Thomas, Kimberley, R. Dean Hardy, Heather Lazrus, Michael Mendez, Ben Orlove, Isabel Rivera-Collazo, J. Timmons Roberts, Marcy Rockman, Benjamin P. Warner, Robert Winthrop. (20180. Differential Vulnerability to Climate Change Across the Social Sciences: A Review. WIREs. DOI: 10.1002/wcc.565. [Marcy Rockman, United States of America]	Accepted. Text revised and reference added.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17283	1	23	17	23	24	Important historical context is essential in any mention and discussion of disparities and inequities. This paragraph is certainly critical in providing contextual information but could be improved by including the recognition of the role that colonization played (and plays) in creating and perpetuating these disparities and inequities. For example, in Canada the forced relocation of Indigenous Peoples, the residential school system that existed into the 1990s, and the widespread dog slaughter are all colonial legacies that have a large and direct role in the ongoing inequities in health, education, employment, etc. for Indigenous Peoples. Supporting documentation can be found in the reports and findings of the Truth and Reconciliation Commission of Canada and is repeatedly included in Canadian Arctic climate change peer-reviewed publications. It is prominant acorss this literature and as such should be noted here. [Joanna MacDonald, Canada]	Accepted. Text revised to include the concept of history.
18349	1	23	17	23	41	"Vulnerabilities in Human Systems"... mentioning level of confidence for these two paragraph might increase its impact [APECS Group Review, Germany]	Taken into account in Chapter 2, 3, and 4, and Cross-Chapter Box 7.
5249	1	23	18	23	19	I propose include the environmental factor. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted. Text revised.
1353	1	23	23	0		Citation needed [Jacinta Clay, United States of America]	Accepted. References added.
26283	1	23	32	23	34	Suggest rephrasing the sentence. Damage does not illustrate weak components ... it is the response to the damage that illustrates ... [Zelina Ibrahim, Malaysia]	Taken into account. This part of the sentence was deleted.
5585	1	23	38	23	38	Add after "static" the words "in place and time " to make the text more informative and specific. [Judy Lawrence, New Zealand]	Accepted. Text revised.
28083	1	23	38	23	40	Excellent to see this so clearly stated here! A relevant reference, if one is desired, recently developed by academic and federal policy makers via the US Global Change Research Program is Thomas, Kimberley, R. Dean Hardy, Heather Lazrus, Michael Mendez, Ben Orlove, Isabel Rivera-Collazo, J. Timmons Roberts, Marcy Rockman, Benjamin P. Warner, Robert Winthrop. (20180. Differential Vulnerability to Climate Change Across the Social Sciences: A Review. WIREs. DOI: 10.1002/wcc.565. [Marcy Rockman, United States of America]	Accepted. Reference added.
25387	1	23	38	23	41	This is a very important point that vulnerability is not experienced in a homogenous way – it highlights social inequalities in the consequences of climate change – could it be brought out more in the executive summary and emphasised? [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
13763	1	23	44	23	44	I'm not sure the title quite reflects the contents of the this section. The section includes a short discussion on mitigation which isn't captured by "addressing consequences". Perhaps "Addressing causes and consequences of climate change..."? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Excellent suggestion. Title changed accordingly.
23021	1	23	44	23	44	Section 1.6 to be considered carefully and align with the approach in SR15. Text not to be prescriptive. Ethics and equity, sustainability to be expanded with a focus on impacts and response options related to the ocean and cryosphere. Some issues need further development here such as maladaptation. [Valerie Masson-Delmotte, France]	Taken into account. Prescriptive language has been removed and ethics and equitity are taken into consideration in CCB2.
26285	1	23	44	26	51	The discussion here presents both mitigation and adaptation. There is also discussion of socio-economic approaches. However the sub-sections of 1.6 (1.6.1 and 1.6.2) are only on adaptation. [Zelina Ibrahim, Malaysia]	Section 1.6 is "Addressing the consequences of climate change for the ocean and cryosphere" which is what the introductory text and subsections discuss.
13765	1	23	46	23	46	"goals" should be changed to "temperature goal" [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text changed accordingly.
32551	1	23	46	23	49	Once again, the statement only addresses the reduction in risks by adaptation, but lack of emphasis to maximise services that ocean and cryosphere may provide. This issue might exist in the whole chapter. [XIAOMING WANG, Australia]	Reducing the risks implies minimizing the loss of services.
11815	1	23	46	23	54	Mention exploding pingos in Siberia. [William Lorenz, Australia]	Noted but the release of methane cannot be cited in the framing chapter. Mentioning sources of greenhouse gases emissions is out of scope.
14911	1	23	48	0		Please replace the term "loss and damage" by "residual risk and associated (potential) losses" as agreed in the AR6 outline, here and throughout the report as appropriate. [Government of Germany, Germany]	Noted but since the loss and damage is anchored in the literature (box of SR1.5 cited), the author team believes it can be mentioned here with that citation..
11623	1	23	49	23	51	In addition, [...] refers to human actions (political, technological, social, economic, cultural, and so on) to limit [...] whereas adaptation are arrangements and adjustments actual, expected [...] [Government of Mexico, Mexico]	The lack of space prevents to provide additional details. On "arragnements and adjustments", we use the glossary definition.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5587	1	23	50	23	52	The definition of adaptation is very narrow and not consistent with previous IPCC definitions. "adaptation is the process of adjustment to the actual, expected, and partly unavoidable impacts of climate change (Agard et al 2014)" and inconsistent with recent adaptation research that develops tools for addressing uncertainty. It would appear not to include dynamic adaptive policy pathways for example which explicitly address uncertainties (unavoidable risk) Refer Walker W.E. et al 2013 and Stephens, S., Bell, R., Lawrence, J., 2017. Applying Principles of Uncertainty within Coastal Hazard Assessments to Better Support Coastal Adaptation. Marine Sciences and Engineering 5, 20. Nor does it contemplate transformational adaptation on the face of the words. The notion of precaution in early definitions of adaptation have been lost. This needs to be addressed. [Judy Lawrence, New Zealand]	The definition given is actually taken from the glossary of AR5 WGII (Agard et al., 2014)
32301	1	23	53	23	54	A reference should be given here, for example: https://www.becausetheocean.org [Jean-Pascal van Ypersele, Belgium]	The chapter team feels inappropriate to cite a web site.
22701	1	24	2	24	2	The sentence 'Other mitigation options exist, including solar radiation management' is unqualified and could be taken to imply that they are all tested and acceptable, and could be selected as options. This is very far from the truth and such technology is to be opposed on ethical and precautionary grounds. Suggestion to edit text to: "Other mitigation techniques have been proposed, including solar radiation management and several other forms of geoengineering but these are not addressed in SROCC as they are covered in other products of the IPCC Sixth Asessement Cycle (SR1.5 and AR6 Working Group III)" [Greeenpeace Group Review, Republic of Korea]	Accepted. Text changed accordingly.
4969	1	24	3	24	3	Although solar radiation management is presented in Chapter 4, it is not included in the pathways assessed in SR15 (see SPM C1,4). SR1.5 also does not use the term 'geoengineering'. Rather, it deals with SRM and CDR separately. Solar radiation management is also not regarded to be a form of mitigation in SR1.5. [Debra Roberts and Durban Team, South Africa]	Accepted. Text changed accordingly.
5463	1	24	3	24	3	solar radiation management & Solar intensity [rashidian leila, Iran]	SRM is the broad concept used in the IPCC
5465	1	24	3	24	3	local geo-engineering for solar intensity & solar radiation is very important [rashidian leila, Iran]	As mentioned in the text, SRM is not covered in this report. It is covered elsewhere in AR6 products.
5517	1	24	3	24	3	It's suggested that "solar radiation management" will be changed to" Solar radiation engineering". [Government of Iran, Iran]	We prefer the use of SRM which is by far the most common expression used to describe this group of thechniques.
5519	1	24	3	24	3	its suggested to moe notice to local effects of solar radiation and intensity rather than regional or global effects. [Government of Iran, Iran]	As mentioned in the text, SRM is not covered in this report. It is covered elsewhere in AR6 products.
11817	1	24	3	24	3	Solar radiation does not stop the effects of ocean acidification. [William Lorenz, Australia]	That is correct but, as mentioned in the text, SRM is not covered in this report. It is covered elsewhere in AR6 products.
13767	1	24	3	24	3	This sentence is inconsistent with the definition of mitigation in the first paragraph of this section. Solar Radiation Management generally isn't counted as mitigation. It would be helpful if 'solar radiation management' is referred to as in SR1.5, or alternatively this sentence could just refer to geoengineering. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted; a mistake which will be corrected.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1355	1	24	7	0	10	Needs plastic pollution acidification citation. [Jacinta Clay, United States of America]	The author team is not aware of a link between plastic pollution and ocean acidification. A reference would have been useful.
22703	1	24	8	24	10	The biological and ecological relevance is weak throughout the chapter except this sentence. This could be linked with risks and ways to address the risks. Especially, these indirect measures to support biological and ecological adapation help to build resilience. Pollution reduction and conservation are simpler local mitigation efforts to climate change [Greeenpeace Group Review, Republic of Korea]	Pollution reduction and conservation are not mitigation measures as defined at the beginning of section 1.6, a definition which is standard in IPCC reports....
29901	1	24	8	24	10	not clear how this is mitigation here [Anna Zivian, United States of America]	This is a mistake which will be corrected.
32607	1	24	8	24	10	re mitigation with ocean, blue carbon sequestration was already mentioned in the SPM (albeit as a small knob to turn), so here focusing more narrowly on pollution and conservation seems more narrow than previously laid out. [Kim Cobb, United States of America]	Chapter 1 is a framing chapter introducing the subsequent chapters. Blue carbon is not specifically mentioned but the other approaches to address the causes of climate change are not either. Beside, reducing pollution and conservation are not mitigation measures. They are includes in a group defined as measures to support biological and ecological adaptation (see Fig. 1.2).
8731	1	24	10	0		Remove 'of'. [Nina Hunter, South Africa]	Accepted.
13769	1	24	12	24	14	The first half of the paragraph needs to be clearer as to what it's referring to. It says "mitigation measures" but seems to be specifically referring to carbon dioxide removal techniques rather than ocean-related mitigation measures more generally (which could include things like reducing ship emissions). In fact, this whole section could be clearer on the role and importance of mitigation (reducing emissions). At present it mixes up several things (mitigation, SRM, CDR) and some sentences, taken out of context, could give the impression that mitigation measures have negative impacts. Also, there's nothing about the importance of reducing CO2 for slowing ocean acidification. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	The confusion likely stems from the poor writing of one of the section which implied that SRM was a mitigation technique, which it is obviously not. This will be fixed. It is a good idea to add reduction of ship emissions in Fig. 1.2 in addition to the other measures to address the causes of climate change. Of course none of the approaches shown in Fig. 1.2 can be discussed in detailsin the framing chapter. They are described elsewere in the report.
22705	1	24	13	24	13	Uncertainties from ocean-based CO2 removal methods in the likes of (Rayfuse et al, 2008, DOI:10.1163/092735208X295846; Vaughan and Lenton, 2011, DOI: https://doi.org/10.1007/s10584-011-0027-7) make the use of the word "disbenefits" inappropriate to describe the risks associated with large scale geoengineering. Suggestion to use "negative implications" or "complex unintended consequencies" instead of "disbenefits" to appropropiriately address the issue. [Greeenpeace Group Review, Republic of Korea]	Taken into consideration. We now use "adverse side effects"
28333	1	24	13	24	16	"disbenefits". I would urge you NOT to use this word. It is extremely important that scientist are seen to name a cat a cat, and in this context "drawback" is far better. [Anne GUILLAUME, France]	Taken into consideration. We now use "adverse side effects"
1357	1	24	14	0		"The greatest benefit is derived..." greatest benefit for what? [Jacinta Clay, United States of America]	This sentence has been revised for clarification.
16673	1	24	15	24	15	Typo "--" [Samuel Morin, France]	Yes, will be corrected.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9481	1	24	16	24	18	We suggest to provide examples of « local efforts to decrease air pollution ». [Government of France, France]	An example will be given (reducing black carbon emission)
16675	1	24	16	24	18	Reference could be given to Section 2.2.2 and/or Box 2.2. [Samuel Morin, France]	Citation to the box will be added.
4271	1	24	21	24	22	We do many "manipulations" of ecosystems' structure - mangrove restoration is one, fishing is another, rebuilding stocks is another. Not all manipulations minimize cc pressures as the text may suggest [Manuel Barange, Italy]	"may" is used, so we do not imply that all manipulations minimize climate change pressures
30537	1	24	23	24	24	Also direct adaptation for humans eg vaccines, mental health support [Hans-Otto Poertner and WGII TSU, Germany]	This is covered in the text (community-based actions (changes in policies and practices)
5593	1	24	23	24	26	This sentence is only half the story. Mitigation actions can make adaptation more difficult and some adaptations can increase GHG emissions. It would be helpful for the reader to include this point. This is the reason why mitigation and adaptation need to be consider alongside one another. It is not just about limits to adaptation. [Judy Lawrence, New Zealand]	Accepted. The text has been revised accordingly.
26835	1	24	31	0		Change "used" to "assessed" [Ko Barrett, United States of America]	Accepted.
11637	1	24	31	24	31	The use of Total Economic Value renders underestimated values since it is a simple summation of values and does not reflect the panarchy and emergence fostered by ecological functions. It should be noted in the report that TEV is the best available proxy since economic valuation of ecosystem services is not able tofully appraise complex systems like ecosystems [Government of Mexico, Mexico]	Noted. None of the methods are perfect. It is impossible to give an exact monetary value to biodiversity.
11625	1	24	31	24	32	"In SROCC, two main economic approaches are used. The first comprises the Total Economic Value method to attach monetary value to non-market good." The total economic value method also may value market goods. According to TEEB (2010) to calculating the total economic value of ecosystem services, the information is collected on individual's preferences as seen in their market transactions relating directly to the ecosystem service (the direct market valuation approach: market price-based, cost-based, and production function-based). [Government of Mexico, Mexico]	Accepted. This text has been changed extensively (and shorthened due to space constraints).
26837	1	24	38	0		Change "used" to "assessed" [Ko Barrett, United States of America]	Accepted.
1359	1	24	40	0	41	A citation might be beneficial at the end of this sentence. [Jacinta Clay, United States of America]	Accepted. The link to the section where these methods are treated has been included.
9483	1	25	0	0		We suggest to provide a brief definition of « assisted evolution » (active intervention to accelerate the rate of naturally occuring evolutionary processes). [Government of France, France]	Accepted, it will be added to supplementary table 1.1 (Fig. 1.2 will be much simplified by moving the definitions to a supplementary table).
8733	1	25	0	0		Figure 1.2 needs editing for consistency of language within the figure. [Nina Hunter, South Africa]	Consistency will be checked. Reference to specific inconsistencies would have been useful.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5595	1	25	0	25		It is a mistake not to include governance based solutions in this diagram. By leaving it out reinforces the current paradigm where many solutions are identified but their enablers are not. This is a huge problem for adaptation which is seen as a set of technocratic issues. This is one of the biggest barriers to effective adaptation. There is plenty of literature on this issue including Eisenack/ Biesbroek/ Lawrence et al 2015. This literature should be known to the Lead authors of this report. Here is the opportunity to make the linkages along the bottom of the Figure 1.2 or as part of an expanded right hand list. Because governance and instituoons are where the transformational change will occur to put mitigation and adaptation into effect it should sit across the bottom of the Figure as an enabler with an arrow down from "taking action and moving the key. The title of the Governance part could be "Supporting risk reduction" or similar. [Judy Lawrence, New Zealand]	Taken into account. We agree but decided against adding governance to the figure itself because governance and enabling conditions are implicitly embedded in all mitigation and adaptation measures shown. This point has been made clear in the figure legend.
15433	1	25	0	25		Perhaps we could merge conservation and restoration/enhancement of habitats and ecosystems? Separation does not seem warranted? Any reason behind it? Is this categorisation used by IPBES? [EUCE, Belgium]	Noted. We keep these categories separate in order to be consistent with the literature cited.
32609	1	25	0	25		the small text that is annotated below each action category could probably be reduced or completely eliminated; it makes the figure very busy, hard to approach [Kim Cobb, United States of America]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
1361	1	25	1	0		This figure takes up too much space, has too small text, and is confusing. I think it should be deleted or else otherwise made into a table. [Jacinta Clay, United States of America]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
14913	1	25	1	0		Figure 1.2: the chart describes the main responses quite well and may also be helpful within the SPM to visualize mitigation and adaptation issues [Government of Germany, Germany]	This will be suggested to the SPM authors team.
31575	1	25	1	0		Figure 1.2. Because each type of response is addressed throughout SROCC, please consider the option of reducing text within this figure by ommiting the short descriptions that provided under each type of response. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
74	1	25	1	25	1	Figure 1.2: This figure has too many words. There should never be more words in the figure than in the caption. Also, the words are so small that the figure is useless for presentations. [Baylor Fox-Kemper, United States of America]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
3137	1	25	1	25	1	This figure is slightly confusing and it is difficult to grasp the key concepts by quickly looking at the information, which I think is an important purpose that a figure should serve. It may be more efficient and effective to present the information in a more digestible way, such as in a table or in paragraph form. [Sloane Garelick, United States of America]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
3437	1	25	1	25	1	There seem to be some duplicate points in the three categories. What is the specific meaning of "pollution reduction"? Does that refer to non-GHG pollution, such as environmental contaminants? Additionally, the duplicate coloring system is confusing overall and does not add to the impact of the figure. [Patrick Orenstein, United States of America]	It is "land-based pollution reduction"; it will be clarified in the FGD. We disagree with the view that the color scale is unnecessary.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11383	1	25	1	25	1	This figure is too wordy, it doesn't help visualize/simplify the message that wants to be portrayed here. [Anson Cheung, United States of America]	Accepted. Fig. 1.2 will be much simplified by moving the definitions to a supplementary table.
32017	1	25	1	25	1	"Carbon capture and storage" should have an orange rather than red circle. [Christian Reuten, Canada]	This is actually incorrect. CCS decreases the sources but does not actually increases the sinks. Alone, it does not remove CO2 from the atmosphere, but it can reduce atmospheric CO2 if it is combined with bioenergy production (BECCS). BECCS is also shown in Fig. 2 with two colored dots to indicate that fact.
13771	1	25	1	25	8	It would be helpful if 'solar radiation management' feasibility is referred to as in the 1.5 Special Report, or alternatively this sentence in the figure caption could just refer to geoengineering. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Referring to just geoengineering would actually be incorrect. Geoengineering includes both carbon dioxide removal and solar radiation management. The figure and the report are addressing CDR.
13773	1	25	1	25	8	Could the figure include 'co-benefits' for options, potentially with the addition of another coloured dot? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	That would have been a great addition but it is unfortunately not feasible. We are aware of an assessment of the cobenefits of ocean-based approaches (Gattuso et al. 2018) but the is no published report assessing quantitatively or semi-quantitatively the cobenefits of all approaches shown in Fig. 1.2 using the same metric.
32851	1	25	1	25	8	At the top of Figure 1.2, assisted migration should be added to the list of actions to support ecological/biological adaptation -- more practical than "assisted evolution". Also need to mention assisted corridor protection/restoration coupled with migration/ translocation in Section 1.6.2. Barriers to migration will increase the chances of exctinction for some species (see Everglades examples of species being considered for assisted migration). https://www.biologicaldiversity.org/publications/papers/BiodiversityOnTheBrink_2015.pdf [Government of United States of America, United States of America]	Accepted, we will add assisted migration under Restoration and enhancement.
15431	1	25	3	25	3	The distinction between observed impacts of climate variability vs. change is not always clear or stated. [EUCE, Belgium]	It seems that this comment is misplaced. It does not relate to page 25 line 3.
1363	1	25	13	0	21	There is only one citation in this paragraph and maybe more would be beneficial. [Jacinta Clay, United States of America]	Noted: The sentence is about what AR5 concluded and the reference is directly to AR 5. The rest of the section, where the AR 5 finding are elaborated, contains appropriate additional references.
32853	1	25	13	26	13	Section 1.6.1 overemphasizes evolution and neglects natural migration to suitable habitats. Need to add text that explains how plant and animal species respond to the changing environment -- allowing them to persist but in a different location, if there are corridors and no barriers to migration. [Government of United States of America, United States of America]	Accepted: Pointer is added to Section 1.5.1, where the behavioural responsesare already addressed.
4339	1	25	26	25	26	Maybe add here reference to Frölicher et al. (2018): T. L. Frölicher, E. M. Fischer, N. Gruber, Marine heatwaves under global warming. Nature, 560, 360-364 [The UBern Team Group Review, Switzerland]	Add his reference and make sure it is the full list of LIT cited: Frölicher et al. (2018): T. L. Frölicher, E. M. Fischer, N. Gruber, Marine heatwaves under global warming. Nature, 560, 360-364

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16677	1	25	30	25	30	I suggest replacing "glacial" by "cryosphere", which then encompasses not only glaciers but also the snow cover and permafrost. The effects of the latter are far more important than those from glacial decline alone, as shown in Chapter 2 and Chapter 3. [Samuel Morin, France]	Accepted
11305	1	25	32	26	13	In general, the focus on the potential scope for evolutionary adaptation (paragraph 3) is not up-to-date, nor does it sufficiently capture the policy-relevant steps that could foster evolutionary adaptation. Therefore, it comes across as a generic overview of different forms of adaptation (eg plasticity and evolutionary adaptation), but fails to connect these processes to their very real (and well-established) relevance to species persistence under climate change in the cryosphere and elsewhere. This topic – the scope for rapid evolutionary adaptation to climate change in wild populations -- is perhaps one of the most exciting recent developments at the interface of ecology and evolutionary biology. And yet, paragraph 3 captures none of these conceptual advances, has no references more recent than 2015, and is lacking any references to the considerable scientific body of work specifically addressing the scope for adaptation to climate change. [continued next comment] [L. Scott Mills, United States of America]	Noted: Valid concern and several technical terms revised
11307	1	25	32	26	13	Importantly, this demonstrated potential capacity for evolutionary rescue in some wild species is policy-relevant because it can be fostered by maintaining populations that are large, connected and with reduced exposure to other anthropogenic stressors (See recent Science paper by Mills et al. 2018). Thus, it is separate from “assisted evolution”, a related but different topic discussed to some extent in the document. Here is an edited version of paragraph 3 of 1.6.1 that incorporates these ideas (note that to be sensitive to space constraints I have judiciously added only a few of the many new, recent, and relevant citations that could be added): [see next comment for edited paragraph] [L. Scott Mills, United States of America]	Rejected. Points in the comment are reasonable but are new findings for the respective thematic chapters. In the FRAMING chapter this level of development of marterial new to IPCC assessments is inappropriate,

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11309	1	25	32	26	13	Past IPCC assessments have begun to highlight the importance of evolutionary adaptation as a component of how populations adapt to climate change pressures. Acclimatisation (phenotypic plasticity) can result from changes in gene expression but does not involve any change in the underlying DNA sequence. In contrast, evolution involves changes in the genetic composition of a population over multiple generations via the differential survival or fecundity of different genotypes (Sunday et al., 2014, Zimmer and Emlen 2018). Recent scientific breakthroughs have underscored that evolutionary changes in adaptive traits through natural selection can occur on ecological time scales (Campbell-Staton et al. 2017), making evolution a potentially relevant player (interacting with plasticity) to allow wild animals to adapt to climate change over relevant time scales (Pespini et al. 2013, Hendry 2016, Bell 2017, Cohen et al. 2018) (High confidence). Field studies that address the potential scope for adaptation to climate change in wild species are beginning to accumulate (e.g. heat tolerance [Hinners et al. 2017, van Oppen et al., 2015, Bay et al 2017]; seasonal camouflage against snow [Mills et al. 2018, Jones et al. 2018]; migration and breeding [Reed et al. 2013, Kovach et al. 2012 , Manhard et al 2017]. The effective speed and efficiency of natural selection to adaptively 'rescue' species from climate change depends critically on many factors including population size, standing genetic variation, rate of environmental change, and dispersal of adaptive genotypes (Carlson et al. 2014, Bell 2017). Therefore, natural evolutionary adaptation may be challenged by the speed and magnitude of current ocean and cryosphere changes. Nevertheless, the potential exists to identify 'evolutionary hotspots' for traits with high standing genetic variation and shaped by climate (Mills et al. 2018, Jones et al. 2018); in these areas adaptation might be fostered through human actions centered on maintaining large and connected distributions of wild populations (Medium confidence). Thus, in situ evolution may be nurtured as a new axis for global conservation efforts to promote climate resilience (see Chapters 2, 5). [L. Scott Mills, United States of America]	Rejected. Same point - this is a conclusion that comes from evidence that will be presented in the chapters. Moreover the sentence starting "the efficacy .." highlights the properties of populations needed for evoluntionary adaptation to be favoured
1367	1	25	32	26	2	I don't understand the biological jargon here. Perhaps more common words should be used. [Jacinta Clay, United States of America]	Rejected: See previous two comments. As the comment says, these are new findings, and thus for inclusion in the respectiove chapters, not the opening chapter that just sets the scene.
1365	1	25	33	0	34	I understand the term acclimization, but I do not understand the phrase phenotypic plasticity, which is not in the glossary. Perhaps the paranthetical should be deleted. [Jacinta Clay, United States of America]	Accepted: Wording changed to be more accessible
4275	1	26	1	26	13	In this section it would be appropriate to reflect that the area of adaptation capacity and adaptation pathways is very much in its infancy and the literarture incomplete [Manuel Barange, Italy]	Accepted. Sentence revised appropriately.
11819	1	26	1	26	13	Mention Allee effect constraints due to a changing climate. [William Lorenz, Australia]	Accepted: "Emerging evidence added. Compare this comment with 11305, 11307 and 11309!

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4273	1	26	1	26	2	I am not a geneticist but to say that "adaptive evolution is the subset of evolution that is attributable to natural selection...[which] leads to populations becoming more fit in the environment" sounds rather Lamarkian (adaptive = more fit). Evolution is a process based on random mutations that are maintained if they do not imped the organism's ability to survive and reproduce. [Manuel Barange, Italy]	Rejected: Point currently unresolved in the literature
1369	1	26	10	0		I don't understand the word "plasticity" [Jacinta Clay, United States of America]	Accepted: Word Removed
1371	1	26	12	0	13	A word is missing. *...adaptation and enhance... ? [Jacinta Clay, United States of America]	Accepted: Misisng phrase added"
8735	1	26	13	0		It appears a word may be missing after 'adaptation'. [Nina Hunter, South Africa]	Accepted: Misisng phrase added"
17287	1	26	15	26	51	This section should include a specific paragraph on Indigenous-led adaptation. While it is acknowledged that people pioneer adaptation, there is a failure to capture the massive contribution that Indigenous-led adaptation action has contributed to overall global adaptation action and effort. Specifically in the Arctic, innovative technologies (eg. SIKU, an Inuit knowledge wiki and social mapping platform (https://arcticeider.com/en/about), SmartIce (https://www.smartice.org/)) and practices have been created and sustained by Inuit communities who have had to adapt to climate changes for over a decade. Not only is it researchers and scientific evidence that is providing information about adaptation, it is also Indigenous researchers, Indigenous knowledge, and considering Cross-Chapter Box 3, and the recognition of Indigenous Knowledge from IPCC, it is important that there be a paragraph in this section about Indigenous-led adaptation (there is certainly no lack of literature on this). [Joanna MacDonald, Canada]	Accepted. A sentence on Indigenous-led adaptation with references is now included.
25389	1	26	17	26	23	but human adaptation also involves behavioural changes (eg management of fisheries, dietary choices etc) which do not come under the categories of retreat etc. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text revised to include behavioural dimensions.
23023	1	26	29	26	29	example of need to have a more balanced approach : adaptation successes => as well as barriers, limits or failures; risk and opportunities. [Valerie Masson-Delmotte, France]	Accepted. Text revised to include these elements.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28085	1	26	30	26	33	Another concept that could be included here is the social acceptance for adaptation acton or social preferences for what to save and what to let go. A relevant reference that describes community perspectives on projected change or loss of cultural and natural heritage at Cape Lookout National Seashore in North Carolina, US is Henderson, M. and Seekamp, E. 2017. Informing Plans for Managing Resources of Cape Lookout National Seashore under Projected Climate Change, Sea Level Rise, and Associated Impacts: Community Members Interviews Report. Tourism Extension Report Series 2017-CALO-001. Department of Parks, Recreation, and Tourism Management, College of Natural Resources, NC State University, Raleigh, NC. http://www.lib.nscu.edu/resolver/1840.20/34902. [Marcy Rockman, United States of America]	Accepted. Text revised to include concept of social preferences.
4973	1	26	30	26	36	Is this not presupposing that funding for adaptation projects will only come from investment institutions? What about public sector funding? [Debra Roberts and Durban Team, South Africa]	Accepted. Text revised to be inclusive of public sector funding.
26839	1	26	31	0		Suggest deleting "investment" and replacing with "individuals and". It is inaccurate to say that priorities for adaptation depend only on investment institutions. This change allows the main point to be made, only accurately. [Ko Barrett, United States of America]	Accepted. Text revised.
17285	1	26	39	26	41	Ice should be included when listing the types of environments in this sentence (coastal, river, mountain, etc.)...ice environments are descriptive of the Arctic and sryosphere specifically. [Joanna MacDonald, Canada]	Accepted. Text revised to also capture polar regions.
26841	1	26	41	0	42	Scenario planning has not emerged since AR5. [Ko Barrett, United States of America]	Accepted. Text revised for clarification.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5597	1	26	42	26	43	these references are not the best at this location.Suggest you use the more recent practice examples such as Stephens, S., Bell, R., Lawrence J. 2018. Developing signals to trigger adaptation to sea-level rise. (2018). Environmental Research Letters. Published on line 7 September 2018. http://iopscience.iop.org/10.1088/1748-9326/aadf96; Lawrence, J, Bell, R, Blackett, P, Stephens, S, Allan, S. (2018) National Guidance for Adapting to Coastal Hazards and Sea-level Rise: Anticipating when and how to change pathway. Environmental Science & Policy [online]; Bloemen, P.; Van Der Steen, M.; Van Der Wal, Z. 2018. Designing a century ahead: climate change adaptation in the Dutch Delta. Policy and Society, 2018, 1-19; and you could add a recent scenarios practice example and the use of serious games alongside scenarios which directly address behavioural aspects of decision making under uncertainty. e.g. Frame, B., Lawrence, J., Ausseil, A., Daigneault, A., Reisinger, A. (2018) Adapting global shared socio-economic pathways for national and local scenarios. Climate Risk Management; and Lawrence, J. and Haasnoot, M. (2017). What it took to catalyse a transition towards adaptive pathways planning to address climate change uncertainty. Environmental Science and Policy. http://dx.doi.org/10.1016/j.envsci.2016.12.003 [Judy Lawrence, New Zealand]	Accepted. Most references were integrated into the text.
26843	1	26	48	0	50	Message in this sentence is not clear. As knowledge sharpens, political and scientific challenges sharpen, and loss and damage sharpen??? What does that mean? [Ko Barrett, United States of America]	Accepted. Text has been removed.
5599	1	26	54	28	53	I am somewhat surprised that the whole governance section including the box is based on papers that come primarily from references around the time of AR5. There have been developments in this area since then and only a very few have been picked up. Has a thorough search of papers around governance/institutions / coasts/ oceans been undertaken? I would have expected many more recent papers especially for the coastal areas. To be useful and to make the important links with governance and institutional arrangements and integrated coastal management need to be discussed in this chapter. In the oceans space the tensions between extractive (fossil fuel prospecting and mining) could also be highlighted as it is a nexus issue where governments are are playing "chicken" with the planet. [Judy Lawrence, New Zealand]	Noted- Text and refeernces changed- however, the text refers to old papers where definitions are presented
25393	1	26	56	27	10	Institutions can also include organisations and groups. Could emphasise that governance tends ot be collective management rather than only government dictating and imposing. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted : text revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
26845	1	26	57	0		Maybe entities instead of rules? [Ko Barrett, United States of America]	Noted : text revised
18239	1	27	1	0		One could use a more widely cited paper to describe the definition of institutions. That could be for example some citation by Elinor Ostrom. See for example E.Ostrom's book 'Understanding Institutional Diversity' (institutions are the prescriptions that humans use to organize all forms of repetitive and structured interactions including those ...). Alternatively, one could use the definition from the book of Douglass North (1990) Institutions, Institutional Change, and Economic Performance ('Institutions include any form of constraint that humans devise to shape human interaction') or the 1991 journal paper of Douglass North - see North, D. C. (1991). Institutions. Journal of economic perspectives, 5(1), 97-112 ('Institutions are the humanly devised constraints that structure political, economic, and social interaction'). If the Roggero et al is to remain though, then the citation needs to be cross-checked. It appears that this is a 2018 paper and not 2017 (see full reference in p. 66). Roggero, M., Bisaro, A., & Villamayor-Tomas, S. (2018). Institutions in the climate adaptation literature: a systematic literature review through the lens of the Institutional Analysis and Development framework. Journal of Institutional Economics, 14(3), 423-448. [APECS Group Review, Germany]	Rejected: Due to problems with space, limited and most relevent references are cited.
13775	1	27	5	27	52	This could be shortened. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted
25929	1	27	7	27	8	Example of where there is repetition (also e.g. Line 13-14). Rethinking sectinos 1.4-1.7 and reducing them as suggested earlier will avoid such repetitions. [Regine Hock, United States of America]	Accepted - Text changed
8737	1	27	9	0		Remove 'a' before 'political' [Nina Hunter, South Africa]	Accepted - Text changed
17289	1	27	13	27	15	A top example within ocean/cryosphere that points to the need for transboundary governance that should be mentioned here in the Pikialasorsuaq Commission (this is mentioned and described in detail in Ch. 3 and in this chapter in cross-chapter box 3.) This Pikialasorsuaq is the North Water Polynya that is shared by Canada and Greenland. This should be mentioned here with acknowledgement that governance systems relevant to this case include Inuit governance structures working with others (eg. Government of Canada) for management of this area. [Joanna MacDonald, Canada]	Rejected: Due to problems with space it is dificut to add more references or example. More details are in chapter 3.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4975	1	27	22	27	22	"must work in harmony" or "can work in harmony"? The current formulation sounds prescriptive. [Debra Roberts and Durban Team, South Africa]	Accepted - Text changed
29903	1	27	26	27	26	define polycentric governance [Anna Zivian, United States of America]	Acccepted - text inserted
26847	1	27	28	0	29	This is an incomplete list. Land and WGII also highlight adaptation options. Rather than trying to get the list right, just reference this report. [Ko Barrett, United States of America]	Rejected: We have given reference to the report which is published and so land and WG II has not been refered here.
25931	1	27	28	27	52	This paragraph explains in detail what will be in done in each chapter. This is 1) not symmetric to the other subsections where this is not done. Why for sec 1.7 but not the others? However, I suggest to reduce this greatly together with 1.4-1.6. This here is an example why this middle part of the chapter is somewhat hard to read. [Regine Hock, United States of America]	Accepted - Text revised
17291	1	27	36	27	36	The words 'Indigenous Peoples' should be capitalized here. [Joanna MacDonald, Canada]	Accepted - Text revised
25933	1	27	39	27	40	remove 'SLR'. Avoid acronyms. This one oocurs in this chapter only two more times in the next line, where it can be spelled out or rephrased. [Regine Hock, United States of America]	Accepted - Text revised
4971	1	27	45	27	45	Change 'impact of' to 'impact on' [Debra Roberts and Durban Team, South Africa]	Accepted - Text revised
30509	1	27	55	32	12	This is a really nice and informative Cross-Chapter Box. [Hans-Otto Poertner and WGII TSU, Germany]	Noted with thanks
17029	1	28	0	0		Box 2 seems unbalance, almost nothing is writting about Antarctica. The three case studies refer to the northern hemisphere. Maybe the title should be changed adding "in the northern hemisphere. [Jorge Carrasco, Chile]	Accepted: Text revised
30539	1	28	1	0		As cross chapter boxes are integrative across chapters, the boxes need to point back to the chapters, please add appropriate references [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Text revised
12059	1	28	1	32	10	This long box is suggested to be shortened. [Government of China, China]	Noted - box shortened
17293	1	28	1	32	10	In Cross-Chapter box 2, the issue of governance is well covered. However, lacking in the introduction "Understanding governance in a changing climate" is mention of Indigenous governance structures. Indigenous governing bodies is included in Figure 2 but undersatnding this could benefit from prior mention or context in the text before the figure is presented. A good spot for this would be the description of governance in the first paragraph. A sentence to recognize Indigenous governence structures would be very useful here. In Canada, the federal government actively engages with Indigenous governance structures bilaterally as partners and this is important for climate action in this country, as an example. [Joanna MacDonald, Canada]	Accepted - Text and figure has been revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16849	1	28	1	32	12	Cross-Chapter Box 2: SIDS have been identified as particularly vulnerable country group wrt sea level rise and projected impacts. We would like to ask the authors to extend the case studies to include a SIDS case if possible. For example, Monioudi et al 2018 "Climate change impacts on critical international transportation assets of Caribbean Small Island Developing States (SIDS): the case of Jamaica and Saint Lucia" could be a starting point. [Government of Grenada, Grenada]	Rejected: In order not to expand the lenght of this CCB beyond its limits we refrain from this suggestion and refer to the CCB 9 on LLCI where these issues are addressed specifically and additionally to Chapter 4 (Box 4.1) where the case study of Fiji is elaborated
28449	1	28	1	32	12	Cross-Chapter Box 2: SIDS have been identified as particularly vulnerable country group wrt sea level rise and projected impacts. We would like to ask the authors to extend the case studies to include a SIDS case if possible. For example, Monioudi et al 2018 "Climate change impacts on critical international transportation assets of Caribbean Small Island Developing States (SIDS): the case of Jamaica and Saint Lucia" could be a starting point. [Government of Saint Lucia, Saint Lucia]	Rejected: In order not to expand the lenght of this CCB beyond its limits we refrain from this suggestion and refer to the CCB 9 on LLCI where these issues are addressed specifically and additionally to Chapter 4 (Box 4.1) where the case study of Fiji is elaborated
18203	1	28	7	0	9	The document could benefit from additional explanation on how and why those 3 case studies where chosen. [APECS Group Review, Germany]	Rejected: The explanation has already been given in page 28 line 33-44.
4977	1	28	12	28	14	This definition seems to be broader than the one offered on page 27 lines 26-27. [Debra Roberts and Durban Team, South Africa]	Accepted - text revised
4277	1	28	19	28	20	"..e.g. Antarctic treaty, REGIONAL FISHERIES MANAGEMENT ORGANIZATIONS" would be a logical addition to recognize the role of RFMOs [Manuel Barange, Italy]	Rejected: We agree with this comment but due to limitation of space we have not been able to accomodate it.
14915	1	28	20	28	25	The important scientific definition of institutions explained here is especially useful for the context of governance and appears also in other parts of the document. Unfortunately, on page 29 in CCB 2, Figure 2 (left corner down, blue) the term institutions "beyond the state" is used with the common wording in the sense of "organizations". As it is used within the same CCB that may confuse the reader. In general the term should be applied coherently and it should be clear to the reader when the scientific definition of institutions (from institutions and social capital literature) is applied. It should be obvious to the reader where the commonly used wording of institutions (with a different meaning) is meant, or the wording there should be changed. [Government of Germany, Germany]	accepted - Figure 2 revised wih lebel - organisations beyond the state"
18241	1	28	29	0		Planning can be specified here for clarity. Planning for the long-term, Planning strategies, Spatial Planning, Climate adaptive planning ? [APECS Group Review, Germany]	Accepted: text revised

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25723	1	28	33	28	44	'Whereas the 'national' scale remains significant for both climate mitigation and adaptation policies --and therefore for obvious reasons retains its centrality throughout the Report-- it will be useful to highlight the strategic significance of other scales (i.e. local to regional to global), especially the regional and sub-regional scales. For example, in the case of South Asia and SAARC region, both vulnerability and adaptation responses have significant regional dimensions. Similarly, many of the impacts of climate change in the Hindu Kush Himalaya region are transboundary in nature. It could be useful to list out challenges that constrain regional cooperation including limited scientific understanding and assessment of transboundary impacts (e.g. glacial melts), and limited institutional arrangements and experience with conceiving, implementing and monitoring regional initiatives and projects." [Government of India, India]	Rejected: Due to space issues, this has not been taken up though the point is good. However, chapter 2 has dealt with this in detail.
30505	1	29	0	29	2	Define UNCLOS and EEZ in figure caption [Hans-Otto Poertner and WGII TSU, Germany]	Acccepted - text inserted
18199	1	29	0	0		Box 1 Figure 1 refers to the 'Freedom of the high seas'. Explanation of the (legal) definition should be provided in the main text of the document, in Ch.1. Relevant literature can be used to refer to background information, e.g. Scovazzi, T. (2004). Marine protected areas on the high seas: some legal and policy considerations. The International Journal of Marine and Coastal Law, 19(1), 1-17. [APECS Group Review, Germany]	accepted - text revised
18205	1	29	0	0		The way the 3 case studies are illustrated in Figure 1, Cross-Chapter Box 2 are not directly comparable; Especially Case study 1 Vs. Case studies 2 & 3 [APECS Group Review, Germany]	accepted - figure revised
18243	1	29	0	0		Those figures can be explained better in the text. For example in Figure 2, although most people are familiar with the shortcut NGOs, that is not necessarily the same with CBOs (I would imagine) - Community Based Organizations, so those can be spelled out somewhere in the texted. In addition to that, for Figure 1 more explanation can be provided for Territorial Sea, EEZs (also maybe include the nautical miles, 12nm and 200nm respectively) etc. [APECS Group Review, Germany]	accepted - text revised
4279	1	29	0	29		FIG. Box2.1 = 1. UNCLOS is not an example of "exclusive government control". 2. The "freedom of the High Seas" in UNCLOS refers to the fact that all countries have a right, but the High Seas are ot "FREE", in the sense that UNCLOS, the 1995 Fish Stocks Agreement, and all the RFMOs control access and activities in the High Seas. [Manuel Barange, Italy]	accepted - Figure revised
4281	1	29	0	29		FIG Box2.2 = this is a very unhelpful figure. 1. The governance of the oceans and coasts… is not a provincial/ sub-national issue. 2. Multilateral agreements can affect Regional issues too. 3. Trans-regional agreements are not "emerging", as some (e.g. Tuna commissions) have decades of history. 4. Civil society seems to be operating at sub-local level? In summary, I think this figure confuses the reader more than it clarifies governance. [Manuel Barange, Italy]	accepted - Figure revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18361	1	29	0	29		Cross-Chapter Box 2, Figure 2: Indigenous or traditional governing bodies would be better categorized not in red as part of the state, but rather in yellow as part of trans-regional and sub-regional governance. [APECS Group Review, Germany]	accepted - Figure revised
21645	1	29	0	29		The meaning of "high seas" in this Cross-chapter Box2, Figure1 is ambiguous. It is assumed that readers need to replace word that are easy to understand. [Government of Republic of Korea, Republic of Korea]	accepted - Figure revised
22619	1	29	0	29		The meaning of "high seas" in this Cross-chapter Box2, Figure1 is ambiguous. It is assumed that readers need to replace word that are easy to understand. [IN-SEONG HAN, Republic of Korea]	accepted - Figure revised
23025	1	29	0	29		Does the wording "governance of the cryosphere" make sense outside Antarctica? [Valerie Masson-Delmotte, France]	Noted - yes it does - we have reivsed the text.
32611	1	29	0	29		I'm wondering whethere there should be a more direct connection between research institutions (via individual scientists or teams of scientists/engineers) and the local/regional governments; this is hopefully what we are moving twoards - the fewer intermediaries between the experts and the policy-makers the better, I think, in terms of deriving evidence-based policy and practice [Kim Cobb, United States of America]	Noted - see changes in figure CB 3.2
1373	1	29	1	0	7	I think this section is very well written and perhaps as a consequence of that, I do not find either figure helpful to understanding the content. In fact, I find the figures deeply confusing and I feel like I have little understanding of what they are trying to tell me. I would suggest replacing the upper figure with a series of pull-quotes or bolded table about each case study. Additionally, I would place it after the description of the case studies. [Jacinta Clay, United States of America]	Accepted - Figure revised
76	1	29	1	29	1	Cross-chapter box 2, fig. 1: This figure needs axis labels. [Baylor Fox-Kemper, United States of America]	Rejected. We think it will be too much to show in one figure and it will confuse the reader. Also, if we put the x labels we need to explain the relationship and this is not the objective of our figure.
3429	1	29	1	29	1	Figure 1- there are three different "x-axes" - description, legal terminology, and types of governance. These are so far apart that it's difficult to see where the different divisions line up and where they overlap. [Patrick Orenstein, United States of America]	Accepted - figure revised - We offer a different vision between law and governance. One thing is what the law permit and the other is how governance can be organized within the limit of the law. Here we have a regulatory frame (UNCLOS) and we must show how governnace works within this frame and if governance and if the law is ready to face the new climate change challanges and can stil "fit for purpose" and regulate new forms of governance. This means we will rework the figure which will certainly clarify the points of this comment
16477	1	29	1	29	1	The Arctic in the cartoon looks much more like Antarctica - this should be changed [Georg Kaser, Austria]	Accepted - figure revised
32019	1	29	2	29	7	This comment applies to much of chapter 1 whenever the term "institutions' is used. The Glossary provides its sociology based definition meaning rules and conventions, but repeatedly in the text and in figures such as this one it is used in the more commonly used sense of a society or organization. In some circumstances this becomes very ambivalent. [Christian Reuten, Canada]	Accepted - text revised

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32855	1	29	2	31	9	The case studies in this text box should include at least one small island nation. [Government of United States of America, United States of America]	Rejedcted - see comments for 28449
17295	1	29	4	29	7	In Figure 2, the box that include NGOs and CBOs should also include IPOs (Indigenous Peoples organizations). This is a manjor constituency at the UNFCCC as well as one of the three categories (in addition to states and NGOs) at the IUCN for example and very different from "Indigenous or traditional governing bodies" that are included in another box. Furthermore, note that it is inappropriate to lump together Indigenous and traditional bodies as this may be interpreted as 'Indigenous' and 'traditional' being synonymous. Indigenous Peoples have distinct rights (as per the UN Declaration on the Rights of Indigenous Peoples) and as such, as rights holders, there is an obligation to engage with Indigenous governance structures. This does not hold true for traditional governance bodies. As such, 'or traditional' should be removed here or seperated into another box. [Joanna MacDonald, Canada]	Accepted - figure revised
30503	1	29	4	29	7	Acronyms in this figure (NGO, CBO) have to be defined in figure caption [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - figure revised

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2197	1	29	6	32	10	Suggest insertion of a case study for the SIDS as they are important and clearly indicated in Figure 2. At least three factors have a bearing on their governance challenges and solutions: (1) Intrinsic vulnerability (small size, insularity and remoteness, environmental factors, demographic factors, economic factors) (Pelling and Uitto, 2001); (2) Limited finances for climate change adaptation (Robinson, 2018); (3) Wealth of LK and IK when compared to urbanized low-lying coasts (UNEP, 2014). Therefore, this results in a strong need for international financing but has not been sufficient (Robinson and Dornan, 2017), pool-governance for the SIDS (Kelman, 2016) and consideration of island IK and LK to reduce governance conflicts (Donner and Webber, 2014). Culturally appropriate planning horizons of 20 years or more can reduce uncertainty and trade-offs between adaptation options which are often technical- or science-based (Donner and Webber, 2014) (mentioned later in chap. 4, p. 4-123, lines 14-19); this reinforces the consideration of “adaptation pathways” and LK and IK vs SK especially for the SIDS (see cross-chapter Box 3, figure 1, case #3). Donner, S.D. and S. Webber, 2014. Obstacles to climate change adaptation decisions : a case study of sea-level rise and coastal protection measures in Kiribati. Sustainability Science, 9 (3): 331-345. Kelman, I., 2016. Governance of climate change adaption on Small Island Developing States (SIDS). In J. Knieling (ed.), Climate Adaptation Governance in Cities and Regions : Theoretical Fundamentals and Practical Evidence, Wiley-Blackwell, pp. 355-370. Pelling, M. and J.I. Uitto, 2001. Small island developing states: natural disaster vulnerability and global change. Environmental Hazards, 3: 49-62. Robinson, S-A, 2018. Adapting to climate change at the national level in Caribbean small island developing states. Island Studies Journal, 13 (1): 79-100. Robinson, S-A and M. Dornan, 2017. International financing for climate change adaptation in small island developing states, Regional Environment Change, 17 (4): 1103-1115. UNEP, 2014. Emerging issues for Small Island Developing States. Results of the UNEP Foresight Process. UNEP, Nairobi. [Poh Poh Wong, Singapore]	Rejected - see comments for 28449
23027	1	30	0	30		Some examples rely only on one paper, not critically assessed. Missing any assessment of confidence. [Valerie Masson-Delmotte, France]	Accepted: text revised
5601	1	30	1	31	57	There is an interesting case study from New Zealand that could be included in which a three council Joint committee was formed with 3 iwi Maori groups to undertake a participatory decision making process at the coast in the Hawkes Bay region. It is a first in using adaptive pathways and would show what can be done at the coast to address climate change and what the lessons were. A case study has already been written up and is held by the NZ Ministry for the Environment but could be adapted to fit this chapter. [Judy Lawrence, New Zealand]	Rejcted: could not include due to space issue

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18201	1	30	3	0	8	Consider providing a full citation for UNCLOS in Ch.1 as well as background information. UNCLOS. (1982). United Nations Convention on the Law of the Sea. Retrieved from http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf [APECS Group Review, Germany]	Accepted - text revised
30507	1	30	3	30	5	I suggest to properly introduce the acronym UNCLOS here (not everybody might be familiar) [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - text revised
25935	1	30	4	30	4	add acronym UNCLOS in brackets [Regine Hock, United States of America]	Accepted - text revised
8739	1	30	10	30	16	Remove hyphen - not consistent with use elsewhere [Nina Hunter, South Africa]	Accepted - text revised
18245	1	30	14	0		Instead of the Cassota and Mazza (2015) I would use a more widely cited paper or a more straightforward citation eg directly to the Arctic Council Website [APECS Group Review, Germany]	Accepted - text revised and more references included
18207	1	30	16	0	18	When explaining the scope of the Arctic Council, besides the Arctic Climate Impact Assessment, it is also worth discussing the working groups (e.g. CAFF, PAME, etc) and their contribution in amplifying the voice of people in the Arctic [APECS Group Review, Germany]	Rejeted- We undertand the concern but there is chapter 3 which covers this. CCB has very limited space.
25937	1	30	18	30	18	give ACIA reference [Regine Hock, United States of America]	Rejected - the refernce is already given - Koivurova, 2016 (see page 30 line 18)
5521	1	30	18	31	48	positioning of regions with high probability of landslide is necessary to estimate the risk of climate change effects and manage the mitigating activities. There are many papers and reports about the subject, especially in Iranian mountainous area. [Government of Iran, Iran]	Rejected - This is a good comment but due to space issue, we can not incorporate it now. Thanks.
16679	1	30	23	30	24	Is it really due to glacier retreat or wider changes of the local cryosphere, involving in particular the snow cover ? [Samuel Morin, France]	noted - text revised
25939	1	30	24	30	24	have dried up' may not be quite right. If there is a glacier there will be runoff. Do you mean "have been reduced"? [Regine Hock, United States of America]	Accepted - text revsied
16681	1	30	31	30	31	As shown in Chapter 2, the large scale impact of glacier shrinkage on water resources is generally lower than the concomitant reduction of the snow cover, except in some arid areas for the most arid seasons (see also the recent article by Armstrong et al. 2018 https://doi.org/10.1007/s10113-018-1429-0) . I thus think "from the glaciers" here could be considered as exagerating the actual role played by glaciers in this large scale situation. [Samuel Morin, France]	noted - text revised
22155	1	30	31	30	34	"The conclusion drawn that "decreased water supplies from the glaciers could trigger a breakdown of the 1960 Indus Water Treaty……." is not supported by the cited reference of Uprety and Salman, 2011." [NAYANIKA SINGH, India]	Accepted - text revsied
30533	1	30	36	30	39	Please be more explicit here, what do the confidence levels refer to? Eg that corals have been degraded or that climate change has played a role in the degradation [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - text revsied

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25391	1	30	49	30	49	this last sentence implies that the approach is pretty negative. It should be supported with ref directly or could be rephrased eg as “such approaches require resource and experienced facilitation to derive widely accepted solutions and ensure fair outcomes are achieved across stakeholders with different levels of power”. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - text revsied
25749	1	32	0	0		Deep Ocean Mission being launched by MoES, Government of India, may be indicated here to highlight the need for more ocean observations [Government of India, India]	Noted but this is not included because chapter 1 has very limited space. It can only highlight key progress after AR5 which support other chapters' assessments.
23029	1	32	0	34		Please help the reader understand what is new since the AR5 and capture that in the executive summary. Gaps (eg observation systems) to be also captured and reported (policy relevant e.g. link to assessment of predictability). [Valerie Masson-Delmotte, France]	Agreed. The revised version now highlighted "what's new since AR5".
23031	1	32	0	34		Missing links to other chapters. Ex rather than some brief overview on paleo, explain and map how it is used in the other chapters to help the reader understand how differnet lines of evidence are combined in SROCC. There is a need to sharpen this part (models, reanalyses as well). [Valerie Masson-Delmotte, France]	Agreed. The revised version now improved the links within chapter and across chapters. And this session has been rewritten to show how scientific knowledge has allowed for the assessment findings coming out of the SROCC chapters.
3491	1	32	16	32	23	This is an important and valuable contribution to the SROCC. In addition to stating that this knowledge will be incorporated, it would be good to add that this is increasingly recognized as an important, valuable, and highly reliable source of information. Moreover, finding a way to cite these changes that involves both scientific literature that uses and describes this value, as well as providing a citation or two that comes from these types of knowledges would be excellent. It would be a good way to demonstrate to readers who are as yet unfamiliar with this space that this is appropraite and valuable, as well as be a good way to initate the incoportation of other ways of knowing into the introductory statement as well. (Page 36, lines 27-28 do an excellent job of this, so they would be great sources to integrate above.) [Katherine Bishop-Williams, Canada]	Noted. Given the limited space in this opening introductory paragraph, we can't elaborate more than what we have written. Also, it would bring in duplication.
1379	1	32	19	0	42	The first paragraphs feels undercited. [Jacinta Clay, United States of America]	Noted. This is a very brief openning introductory paragraph, so not specific citations provided.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17297	1	32	21	32	23	See CAPS/bold/underlined section for where this sentence must be changed: "Accordingly, SROCC RECOGNIZES THE IMPORTANCE OF Indigenous knowledge and local knowledge IN UNDERSTANDING how human communities DISCERN and react to changes in the ocean and cryosphere AND HOW CLIMATE CHANGE INTERACTS WITH THE PLANET AND PEOPLE AND BEGINS TO EXPLORE HOW INDIGENOUS KNOWLEDGE AND LOCAL KNOWLEDGE CAN BE APPROPRIATELY UTILIZED IN IPCC ASSESSMENT REPORTS (Sections 1.8.2, 1.8.3; Cross-Chapter Box 3)." This special report DOES NOT utilize Indigenous Knowledge (rather it is beginning to consider and acknolwedge it) and as such the sentence currently in the text is a false claim. For example, in this chpater there is no IK to be seen in the sections on natural systems component, exposure to climate change hazards, or adaptive responses despite there being much to learn from Indigenous knowledge here. The Inuit Circumpolar Council feels very strongly about this point, having been engaged in the development of this report for almost a year. While the recognition of the importance of Indigenous Knowledge and Indigenous partnership in the IPCC assessment process is very encouraging, there is more to be done in order for the IPCC reports to demonstrate ethical and appropriate utilization of Indigenous Knowledge. The limitation on sources informing the IPCC reports (ie. peer-reviewed literature only) and the lack of Indigenous authors are two of many examples of how the IPCC falls short of engaging with and utilizing Indigenous Knowledge. Furthermore, the paragraph currently implies that Indigenous Knowledge does not have a role in assessing climate interactions with the planet and people, that this is only scientific knowledge. This is not a correct assumption, rather Indigenous Knowledge applies to biological and physical systems and includes insights to interactions within plaetary and human systems based on evidenceacquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. As such, this paragraph should be reworked to reflect this rather than promoting false assumptions of Indigenous Knowledge and the role it should have in IPCC assessments. Utilizing IK in IPCC reports requires a longer process than is possible within the timeframe of this SROCC, and if the report intends to highlight the importance of utilizing IK it should also indicate intention as to HOW this will be pursued. [Joanna MacDonald, Canada]	Agreed. This sentence was changed to "Accordingly, SROCC also recognize the importance of Indigenous knowledge and local knowledge in understanding how human communities understand and respond to changes in the ocean and cryosphere"
28087	1	32	21	32	23	So glad to see this perspective and approach. Thank you for the attention to this topic in this chapter and throughout this report. [Marcy Rockman, United States of America]	Thank you
30511	1	32	25	35	15	This entire section on 'scientific knowledge' focuses almost exclusively on physical systems/measurements/observations. What about the biological and chemical sciences, the ecosystems and species? This balance definitely needs to be improved here. [Hans-Otto Poertner and WGII TSU, Germany]	Agreed. Biological/chemical/ecosystems/species are now strengthened.
312	1	32	25	35	16	I think remote sensing should have its own section, rather than being mentioned only in one paragraph. This section could address the observation length plots in Fig. 1.3, which would explain why odd date windows are chosen for analyses present in this report (e.g. 1993-2005). To save space, modelling and reannlysis can be combined into one section. [Ethan Kyzivat, United States of America]	Noted. But given the very limited length of this section, we decided to only separate advances v.s. remainling limitations, so all kinds of observations are more integrated toghether to support the key scientific topics assessed in other chapters. Furthermore, we also decided to keep separating reanalysis and models, because reanalyses can not be grouped into model data.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
316	1	32	27	33	15	You devote a long paragraph to ocean observations, but little to cryosphere. You could explain in-situ ablation measurments, glacial discharge runoff, historical photo comparison, permafrsot boreholes, and glacial ice cores. [Ethan Kyzivat, United States of America]	Agreed. cryosphere observations are now strengthened.
660	1	32	27	33	15	The structure of this subsection is not very clear. It seems that the in situ observations and satellite monitoring are supposed to be covered in separate paragraphs, but the first paragraph on p. 33 (cryosphere) involves both. [Mengxi Wu, United States of America]	Agreed. This subsection has been rewritten.
11385	1	32	30	32	30	I don't think Figure 1.3 shows that our scientific knowledge has greatly advanced. It simply shows there's more data available since mid-20th century. [Anson Cheung, United States of America]	Rejected. "more data available" is one (major) metric indicating that scientific knowlege has advanced.
18231	1	32	31	0		It looks unclear what attribution refers to in this context. Clarification would help. Is it attribution to drivers and factors that influence...? Is it attribution of impacts to...? Eg anthropogenic activities related to climate change? Or? [APECS Group Review, Germany]	Noted. The paragraph has been rewritten.
306	1	32	32	32	32	Perhaps you could specificy "upper ocean temperature" instead of "ocean temperature." [Ethan Kyzivat, United States of America]	Accepted. Rewritten.
30557	1	32	33	32	34	See Fig 1 in Edwards et al 2010 Trends in Ecology and evolution 25: 602-610 for biological examples [Hans-Otto Poertner and WGII TSU, Germany]	Noted. The CPR dataset listed in Edwards et al. 2010 is part of Figure 1.3, while this entire section was rewritten for clarity and length.
1375	1	32	37	0	57	Neither bathythermographs nor Argo floats are terms non-oceanographers would likely be familiar with [Jacinta Clay, United States of America]	Agreed. This section has been rewritten and a lot of technical text removed.
658	1	32	37	32	56	I think it is better to clearly state the usage of biogeochemical floats, although the appropriate references are already included (e.g., Johnson et al. 2017). [Mengxi Wu, United States of America]	Noted. But the discussion about biogeochemical floats has been removed, because they were not highlighted in other chapters (i.e. chapter-5).
310	1	32	38	32	38	Can you define bathythermographs? This is the most technical word in the sentence. [Ethan Kyzivat, United States of America]	Agreed. This section has been rewritten and a lot of technical text removed.
1377	1	32	42	0	43	" Under-sampled ocean regions which are crucial for improved climate and ecological impact 42 studies include marginal seas, boundary currents, and sea-ice covered areas of the polar oceans " this sentence is inefficient and could be shorter: "Under sampled-regions, such as marginal seas, boundary currents and sea-ice covered polar oceans limit climate and ecological impact studies". [Jacinta Clay, United States of America]	Noted. This sentence has been rewritten.
32857	1	32	42	32	44	"Undersampled regions include ..." -- might consider including the Southern Ocean in general here, since it is much more poorly sampled (on average) than the oceans in the N. Hemisphere. [Government of United States of America, United States of America]	Agreed. Change made.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18233	1	32	52	0		Fix the link in the citation Domingues and Palmer (2015). When one clicks on the link provided in the citation that does not lead anywhere. There is an extra square bracket that needs to be removed to access the report. Since the authors include the link, they may as well include the date when it was last accessed for future reference. Links sometimes change or stop working. This is common practice in making references. [APECS Group Review, Germany]	Taken into account. Checked and corrected.
1381	1	35	1	0		If "Carbon Dioxide, (parts per million)" were replaced with "CO_2 (ppm)" there would not be such a great need for the whitespace around the edge and the figure could be made larger. [Jacinta Clay, United States of America]	Noted: however we prefer to avoid acronyms and abbreviations wherever possible to improve accessibility
1383	1	35	1	0		I personally find the amount of text overwhelming. Perhaps if the upper section of the graph was labelled "Predictions" and the lower section was labelled "Observations and Proxy Data" it would be less confusing. Additionally, the graph may be improved by setting all of the ways of knowing (ocean observations, tide gauges, etc…) so their labels begins at the same horizontal indentation) [Jacinta Clay, United States of America]	Noted: will work with TSU on improving visuals.
1385	1	35	1	0		I find the sideways text at the top moderately confusing. Would fewer named regions (Pre-industrial, Present and Recent Past, Near Future, End of-Century, etc…) labelled horizontally above the chart of CO_2/year be easier to read. [Jacinta Clay, United States of America]	Noted: names regions are designed to visually show the key named time periods assessed in SROCC (section 1.9) so we feel they are an essential part of the figure. We will work with TSU to improve visuals.
1387	1	35	1	0		Since there are only four blocks for model simulations should they each be labelled? Momentarily it looks like there are few models for climate past 2100, when in fact 1/10(508)=50ish is not trivial at all. [Jacinta Clay, United States of America]	Noted: we considered this, but for consistency have just labelled the maximum values for each example. The figure presentation has been improved by TSU graphics unit.
25945	1	33	1	33	15	This part seems underdeveloped and biased, and is very different from the good measurement overview for the oceans where all important data types are mentioned, how they are measured including relevant references. Ice sheets and permafrost are mentioned but nothing about snow or glaciers and sea ice. Satellites are mentioned but nothing about insitu measurements. This subsection needs to be expanded and largely rewritten especially given the enormous progress and developments in observing the cryosphere in recent years. IK, LK can be important but here it is mentioned in an almost absurd context. This type of knowledge is hardly relevant for the changes of the Antarctic ice sheet. [Regine Hock, United States of America]	Taken into consideration: This section has been rewritten and only includes major progress since AR5. Ocean and Cyosphere are better balanced. Additionally, the reference to IK & LK has been removed since it is fully addressed in sections 1.8.2, 1.8.3 and CCB 4.
1095	1	33	1	33	7	There are over 30 micrometerorological station located in the arctic permafrost areas. These stations measure CH4 and CO2 releases from permafrost over long-term in a direct, fairly reliable and defensible manner. Perhaps somehting like this should be added after this paragraf. [George Burba, United States of America]	Noted. This was considered but the chapter team decided to not include these aspects due to space constraints.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18235	1	33	2	0	5	One could add the Arctic as well here, besides the Antarctic…'scientific data are scarce for remote areas (and particularly the Antarctic)'. I suggest this because the next sentence refers to Indigenous and local knowledge helping overcome these limitations, which is something that applies better for the Arctic. In addition to the that, the Arctic suffers from scarce scientific data as well. [APECS Group Review, Germany]	Noted. This sub-section has been rewritten and links to IK&LK removed.
18359	1	33	8	33	15	New technologies such as UAV or drones can be highlighted here. [APECS Group Review, Germany]	Rejected. The limitted length of this section can only afford some major progress after AR5 that is adopted by other chapters.
32859	1	33	10	33	13	A very important set of glacier and ice sheet observations that have become widly available due to remote sensing (and associated techniques, in particular, InSAR), and are critically important for predictive modeling, are observations of glacier and ice sheet surface velocity. It might be worth calling these out explicitly here. [Government of United States of America, United States of America]	Noted. This text has been changed extensively and shorthened due to space constraints. The framing chapter cannot focus much on technological developments.
27501	1	33	12	33	12	A small point but add in here velocity of glaciers and ice sheets as this is an important component of mass balance studies using In/Out techniques. [Ruth Mottram, Denmark]	Noted. This text has been changed extensively and shorthened due to space constraints. The framing chapter cannot focus much on technological developments.
18209	1	33	13	0	14	A citation for this could be useful here. [APECS Group Review, Germany]	Noted. This sub-section has been rewritten and the text the reviewer refers to was removed.
320	1	33	13	33	13	re: "Almost all monitoring of the Greenland", important to mention because of their value in validation of satellite and analyses-driven modeling that since 1990 the K-transect, since 1995 the Greenland Climate Network and since 2008 the PROMICE network both provide collectively ~40 ground based surface climate and mass balance component and energy budget component monitoring, with numerous in-situ observations including ablation stakes and radiometers. Van de Wal, R.S.W., W Boot, C J P P Smeets, H Snellen, M R van den Broeke, J Oerlemans.Twenty-one years of mass balance observations along the K-transect, West Greenland, Earth Syst. Sci. Data, 4, 31-35, doi:10.5194/essd-4-31-2012. Steffen, K. and J.E. Box, 2001: Surface climatology of the Greenland ice sheet: Greenland Climate Network 1995-1999, J. Geophys. Res., 106(D24), 33951-33964. Ahlstrøm, A.P., Gravesen, P., Andersen, S.B., Van As, D., Citterio, M., Fausto, R.S., Nielsen, S., Jepsen, H.F., Kristensen, S.S., Christensen, E.L., Stenseng, L., Forsberg, R., Hanson, S., Petersen, D. & PROMICE project team 2008: A new programme for monitoring the mass loss of the Greenland ice sheet. Geological Survey of Denmark and Greenland Bulletin 15, 61–64. [Jason Box, Denmark]	Noted. This text has been changed extensively and shorthened due to space constraints to focus on progress since AR5.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18249	1	33	13	33	15	1.8.1.1. Some mention could be made of the increasing use of drones in monitoring the Greenland and Antarctic ice sheets. See, for example: Ryan, J. C., Hubbard, A. L., Box, J. E., Todd, J., Christoffersen, P., Carr, J. R., ... & Snooke, N. A. (2015). UAV photogrammetry and structure from motion to assess calving dynamics at Store Glacier, a large outlet draining the Greenland ice sheet. [APECS Group Review, Germany]	Noted. This text has been changed extensively and shorthened due to space constraints. The framing chapter cannot focus much on technological developments.
29603	1	33	17	33	42	This subsection seems far too brief. We have a reasonable sense of how much ice was on land globally at various times and about reconstructed temperatures and likely sea levels, and what seems very clear is that (1) most significant climate changes are forced and not random; (2) sea level has been dramatically different in the past, so much that the equilibrium sea level sensitivity seems to be something like 15-20 meters C per degree C change in the global average temperature; (3) and that what is happening is at least comparable to situations that have involved large changes in climate and sea level in the past, etc. I think it really important to be at somewhat quantitative here--what paleoclimate indicates would seem to have really severe implications for the present situation that we are involved in--and I do not see the paleoclimatic lessons very well integrated to what I have read so far. [Michael MacCracken, United States of America]	Noted: The section has been revised to give more specific information about the new contexts that have been gained by palaeoclimate information for SROCC. Chapter 3 has also strengthened its use of palaeoclimate information.
662	1	33	23	33	25	It is better to indicate which proxies can be used for the ocean and which ones for the cryosphere. [Mengxi Wu, United States of America]	Rejected: we haven't done this as the seperation of proxy types isn't a clear ocean or cyrosphere. Instead the proxies listed as all relevant to aspects of ocean and/or cryosphere change.
11821	1	33	24	33	25	Palynology is also a good paleoclimate tool. [William Lorenz, Australia]	Accepted: we haven't listed palynology specifically but have listed "lake sediments" where palynological records come from.
540	1	33	28	33	29	This sentence regarding the decreasing availability of paleoclimate data should be rephrased and perhaps added to. Is it decreasing towards the modern because the surface of a core is often compromised and only at depths which do not inclue the present can be trusted? It is a little confusing to think that even though we may be collecting more cores, the at the information at the time of collection might not be available. [Jenna Pearson, United States of America]	Noted: we have removed this sentence in revising the section, and unfortunately don't have the space to explain this characteristic of temporal availablity more thoroughly.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2405	1	33	28	33	29	You write: "The availability of palaeoclimate records diminishes towards present day (Figure 1.3), reflecting when the records were collected." This is a pretty trivial statement and actually is also distracting from the real issues. Many palaeoclimate studies reach to the date of sampling (e.g. tree rings, stalagmites etc.). The lack of the last few years in palaeoclimate studies is not a big issue as there should be enough overlap with observational data / measurements in earlier years. The real problems are uncertainties and even mistakes in age models, problems with the validity of climate proxies and interpretations, and limited sample resolution. It can easily happen that two studies document the same natural warm phase which due to resolution limits of the age models may be offset by 150 years. When such palaeoclimatic reconstructions are then integrated and averaged, the warm phase is artificially smeared out and rates of change appear reduced compared to the real rates. Have a look at Kemp et al. 2015 (doi: 10.1038/ncomms9890). [Sebastian Luening, Portugal]	Accepted: we have removed the sentence about data availability changing through time. Details on chronological uncertainty are out of scope for this section, but are relevant for where assessments are made using palaeoclimate data.
2407	1	33	31	33	32	You write: "Palaeoclimate records provide a long-term context for assessing if recent observed changes are unprecedented and attributable to anthropogenic climate change (e.g., Sections 3.2, 3.3; Abram et al., 2016; 33 Jones et al., 2016)." It would be better if you add the alternative to the same sentence: "are unprecedented and attributable to anthropogenic climate change or are still within the typical range of palaeoclimatologically documented natural variability". [Sebastian Luening, Portugal]	Noted: we have revised this paragraph to be more specific about where palaeoclimate data provide long-term context in SROCC. "Natural variability" is now mentioned in the first paragraph of this section.
8741	1	33	33	0		Consider replacing 'they' with 'such records' [Nina Hunter, South Africa]	Noted: this wording has been changed in revising the paragraph.
11387	1	33	44	34	11	the term "climate model output" is somewhat confusing. I don't understand why can't we use simpler terms like results from climate model simulations. [Anson Cheung, United States of America]	Accepted. We changed the title to "Model simulation data"
27503	1	33	46	33	54	As most of the SMB (surface mass balance) values reported on in the report as a whole are from regional climate models, I think it is worth adding a sentence here if possible pointing out their use in this context beyond ESMs or global climate models. This is maybe especially so since all three main RCMs (MAR, RACMO, HIRHAM) use external but well developed snowpack/firn models forced by the RCM output to get accurate estimates of runoff from the ice sheets and these firn models [Ruth Mottram, Denmark]	Accepted. Regional climate models are now introduced.
25947	1	33	48	33	48	replace climate by Earth; climate is too narrow in this context here [Regine Hock, United States of America]	Accepted. Text changed accordingly.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24645	1	33	51	33	51	incorect use of the phrase 'climate models'. climate models are defined as models that predate earth system models. Suggest change this sentence to say: Earth System Models (ESM) are models used to predict future climate that explicitly include the carbon cycle and interactions between all Earth systems components. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text changed according to this comment and the definition in SROCC Glossary.
32861	1	33	56	33	57	"... the extent to which processes are explicitly represented or estimated" -- suggest changing "estimated" to "approximated" (which more accurately describeds what model paramertizations do). [Government of United States of America, United States of America]	Accepted. Text changed accordingly.
25943	1	34	2	34	2	unaccounted may be a better word than missing [Regine Hock, United States of America]	Accepted. Text changed accordingly.
24647	1	34	3	34	3	again, misuse of the phrase 'climate model'. Suggesti: Downscaling, including the use of regional models.. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text changed accordingly.
3399	1	34	3	34	4	Sentence is unclear - define downscaling more explicitly. [Patrick Orenstein, United States of America]	Accepted. Text changed accordingly.
22447	1	34	3	34	4	Suggest deleting the word 'better' from the sentence. Downscaling isn't necessarily better across all parameters e.g. temperature. [Government of Australia, Australia]	Accepted. Text changed accordingly.
2409	1	34	6	34	7	You write: "Successful testing of models against observational and palaeoclimate data is critical for model evaluation and development (Bracegirdle et al., 2016)." In order to be transparent it needs to be stated that hindcast performance is still a major probem for climate models. Many publications have reported problems which indicates that there are still many challenges to be tackled before the models can be considered a reliable tool for both climate hindcasts and forecasts. [Sebastian Luening, Portugal]	Agreed but this sentence has been removed.
2827	1	34	13	34	36	I suggest to list some examples of ocean reanalysis datasets that are widely used currently. Their existed problems (such as the sparse temporal resolution (monthly) and general short available period) and possible solutions are suggested to be discussed in this section. [Baoshu Yin, China]	Rejected. Space constraints prevent to list specific examples. And the authors also feel one cannot be comprehensive if we try to list the products.
11389	1	34	15	34	15	The definition of reanalysis products is unclear, for instance what does it mean by combining? [Anson Cheung, United States of America]	Taken into account. Reanalysis product was defined in 1.8.1.2. Thank you for the comment. We have also added the specification 'through data assimilation' to better clarify.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32863	1	34	15	34	29	This would be a good place to include a reference to the multi-decadal global ocean reanalyses from the 'Estimating the Circulation and Climate of the Ocean"" (ECCO) consortium used for climate diagnostics. A good references would be Wunsch and Heimbach (2007) or Wunsch et al. (2009). With respect to 'downscaled and regional reanalyses', it would be good to include mention of the Southern Ocean regional ocean State Estimate (SOSE) of Mazloff et al. (2010) and the coupled ocean and sea-ice ocean eddy-resolving reanalysis of Fenty et al. (2017). Wunsch, C., & Heimbach, P. (2007). Practical global oceanic state estimation. Physica D: Nonlinear Phenomena, 230(1-2), 197-208. https://doi.org/10.1016/j.physd.2006.09.040 Wunsch, C., Heimbach, P., Ponte, R., & Fukumori, I. (2009). The Global General Circulation of the Ocean Estimated by the ECCO-Consortium. Oceanography, 22(2), 88-103. https://doi.org/10.5670/oceanog.2009.41 Mazloff, M. R., Heimbach, P., & Wunsch, C. (2010). An Eddy-Permitting Southern Ocean State Estimate. Journal of Physical Oceanography, 40(5), 880-899. https://doi.org/10.1175/2009JPO4236.1 Fenty, I., Menemenlis, D., & Zhang, H. (2017). Global coupled sea ice-ocean state estimation. Climate Dynamics, 49(3), 931-956. https://doi.org/10.1007/s00382-015-2796-6 [Government of United States of America, United States of America]	Taken into account. Wunsch et al. (2007), Mazloff et al. (2010) and Fenty et al. (2017) have been added.
18251	1	34	20	34	21	1.8.1.4 The phrase "inhomogenous early observational data for assimilation" is too jargony. It would be good to rephrase this. [APECS Group Review, Germany]	Noted, the text has been removed.
27505	1	34	21	34	21	Reanalysis products are really important for forcing regional climate models in order to derive SMB - it may be worth pointing this out and also that in the Arctic they don't always agree very well which can give differences in modelled SMB. See for example Akperov et al., 2018 [Ruth Mottram, Denmark]	Noted, but this subsection does not have space to cover the details, which are assessed in chapters 3 and 4.
9485	1	35	0	0		The figure is not clear enough. Why is there a gap in ocean colour knowledge before 2000 ? [Government of France, France]	Noted: The gap in ocean colour data availability is what is given in the cited reference this ECV (Dowell et al., 2013)
30513	1	35	0	35	14	The acronym ECP needs to be defined in figure caption [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: this acronym has been removed from the figure, and replaced by "Extended RCPs". RCP is defined in the caption
5603	1	35	0	0		it is unclear why only RCP 8.5 and RCP 2.6 are used in the top Figure. More than 2 scenarios and probably 4 would be better to show the range of plausible outcomes. [Judy Lawrence, New Zealand]	Noted: For clarity we only show the two scenarios in this figure. This also follows the SROCC storyline, where we primarily contrast the difference between a low emission and high emission future. See also new CCB-1

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29607	1	35	0	0		I think a number of elements here are pretty confusing. Looking at the chart, lots of the parts of the figure don't seem to make sense until one reads halfway through the caption. In that that is not what people will do first, the figure itself needs to very clearly explain that this has to do with the availability of observations, and is not giving an indication of what the analysis of the observations show. This is really important because the top half of the figure is showing results of observations--not their number, so perhaps the figure should be split in two. On the results themselves, while we may not have precise sea level observations into the past, the history of human civilizations and where ancient buildings were located gives a good indication that sea level has been pretty steady through the Holocene. There is also no indication that study of Earth's climatic history is based on all sorts of different types of convincing and useful observations, so the instrumental record since 1850 or so is not at all the only information on which findings are based (think about ocean acidification, etc.). Overall, I'm just not convinced of the usefulness of the bottom half of this figure. While section 1.8.2 is helpful to some extent there is much more to be said about the usefulness of information from the paleoclimatic record. [Michael MacCracken, United States of America]	Accepted: We have updated the figure caption title to make it immediately clear that the figure is providing illustrative examples of the availability of ocean and cryosphere data. We agree that the instrumental record is not the only information that the assessment is based on, hence our illustrative examples of palaeoclimate data and palaeo-model simulations.
4283	1	35	0	35		Careful about overplaying the role of CPR in such a figure. It comes from a single, much criticised piece of equipment, and have a very patchy coverage (in vertical and horizontal scale as well as temporal). To compare it to SL observations, Remore sensing or model simulations is overvaluing CPR's contribution [Manuel Barange, Italy]	Taken into account: we discussed the different options for representing ecological data on this figure, and decided that CPR was a suitable choice. Details are provided in SM1.4, and we have improved the caption to specify that these examples are "illustrative examples".
23033	1	35	0	35		Be more explicit about the source of information (e.g. which paleo data bases used, which paleo simulation archive, PMIP?) [Valerie Masson-Delmotte, France]	Noted: All data sources and calculation details for this figure are given in the appendix refered to in the figure caption.
14917	1	35	1	0		This is an extremely useful figure, thank you for including it here. To increase its accessibility further, it might help to spell out more clearly (at least in the caption) what the categories spatial coverage and "number of observations" refer to for the individual categories. E.g. does light blue for sea level observations mean that only 5-10% of global coastlines are actually monitored? It may be helpful, in this specific case, to add a table below the figure with descriptions for each variable shown. [Government of Germany, Germany]	Noted: thank you. We will improve the caption and appendix information on this.

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31577	1	35	1	0		Figure 1.3. This Figure is important, but it seems to be reaching a point of saturation in terms of the messages it carries. A few changes in graphic style may help reduce the cluttering, for example 1) for the bars in the background depicting the time periods, you may use light tones of grey, to denote seconday importance and avoid distraction from the main point which is data availability. 2) you may try to shift all Y-axis labels to the left, and then shift the example labels (e.g. 1.1 M, 12k, etc.) closer to the graphs. 3) perhaps you may consider the option of omiting the RCPs and other model simulation data - the depiction of observed and reconstructed data is by itself an important message; with this change, you may then be able to spread the X-axis and allow for a better appreciation of the graphs. 4) I dont see the need to divide the Figures in two panels; you could shift the CO2 part to the bottom in order to better place the Y-labes (on one side would be enough), and hence use only one Y-label for the years. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: The IPCC graphics team has improved the visuals of the figure, and we have also removed all but the "present day" shading from the lower panel to improve readability of the information presented. The CO2 panel needs to be seperate as it is providing a climate change context relative to the IPCC time intervals of interest, while the bottom panel is depicting data availability.
31579	1	35	1	0		Figure 1.3. Caption can be simplified, for example, you may omit the last part which is already clear in the Figure ("including pre-industrial (1850–1900), recent past (1986–2005), present day (2006–2015), near-term (2031–2050) and end-of-century (2081–2100)"). Other details such as the resolution of the spatial grids may be placed in the refered Appendix. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: The sentence on timeframes has been removed from the caption. We have retained the basic information about temporal and spatial coverage of data amount, but removed details on spatial grid size. This detail is covered in SM1.4.
308	1	35	1	35	1	In Fig. 1.3: can the model simulations bar chart be re-plotted to reflect the variation in lengths of individual models to give it a more smoothly-varying appearance like the glacier length observations? My understanding is that CMIP models can choose to extend beyond the minimum number of model years required-- thus there should be variations in this plot beyond the three individual bars. As is, it stands out to the eye as looking too square or grainy, compared to the other bar charts. [Ethan Kyzivat, United States of America]	Rejected: We have retained the current plotting as these are the standard time intervals covered by the different experiments in CMIP5.
664	1	35	1	35	1	Are the curves for ocean observations of different depths (the second panel) stacked? It is unclear from the figure caption. [Mengxi Wu, United States of America]	Noted: No they are overlain rather than stacked. We have removed the data for below 2000m to simplify the representation here. Additional details are given in SM1.4
3139	1	35	1	35	1	The top part of this figure is a very helpful summary for understanding the overall types of data and their results that are discussed in the report. However, the remainder of the figure, which shows the spatial data coverage, may be more suitable in later chapters that address the specific data sets in question. [Sloane Garelick, United States of America]	Noted: We agree that individual chapters will need to deal with specifics of the datasets they rely upon, however we feel it is important for chapter 1 to provide this overview of the range of different data sources and how they have changed in relation to the key assessment intervals in SROCC.
3431	1	35	1	35	1	Figure 3 - In the ocean temperature and salinity observations row, the different depth ranges could be better differentiated, e.g. by using three different colors. [Patrick Orenstein, United States of America]	Noted: This is a good suggestion but would then require additional colour bars to be added and we feel that this would reduce accessibility of the figure. Instead we have removed the data for below 2000m to simplify the representation here, and additional details are provided in SM1.4

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11391	1	35	1	35	1	I don't think providing the number of observations/simulations help contextualize the change in dataset sparseness at all. [Anson Cheung, United States of America]	Noted: However, we think that this is a key message, particularly for the ocean and cryosphere where data sparseness is a major problem in space (e.g. deep ocean, polar regions) and time (e.g. pre-industrial) for assessment reports.
16771	1	35	1	35	1	Replace "tide guages" by "tide gauges" [Samuel Morin, France]	Accepted: this correction has been made.
16773	1	35	1	35	1	It would be good to also include in-situ snow and permafrost observations, if possible. [Samuel Morin, France]	Noted: However we don't feel that we can do this without losing clarity. We encourage chapter 2 to include a version of this figure that can expand more specifically on data availability relevant to high mountain cryosphere.
16775	1	35	1	35	1	The figure is probably correct for the availability of GCM model outputs (CMIP5), but I think it would be worth highlighting that for regional climate model output in many cases (CORDEX experiments in particular) there are far more GCM/RCM model pairs available starting in 1950, so that the historical domain is far shorter than apparent on this plot. [Samuel Morin, France]	Noted: We have made it clear in the revised figure caption that this figure only shows illustrative examples. Additional detail will need to be explored within the chapters as it is relevant to their assessments.
16777	1	35	1	35	1	It may be good to add to "Model simulations" either the fact that these are "Climate model simulations" (hence, no representation of actual chronology of events), or add a "reanalysis" bar as a separate "Model simulations" category, of a very different kind to climate model runs because they assimilate observations. [Samuel Morin, France]	Noted: We discussed this in an earlier version and decided not to include reanalysis data on this figure due to space constraints and difficulty in determing how to represent reanalysis products within the format of this figure.
23901	1	35	1	35	1	We would like to request a clarification of the maximum data availability of model simulations with Paleo and Historical data and ECPs in the lower panel of Figure 1.3. In addition, it should be noted that "the height of bars of remote sensing do not depict the maximum annual data availability" to avoid misinterpretation. [Government of Japan, Japan]	Noted: Details on data sources are given in the SM1.4, including how the illustrative numbers for historical and ECP simulations were derived. The figure caption has been clarified to say that "The amount of data available through time is shown by the heights of the timeseries for observational data, palaeoclimate data and model simulations, ..." (so that remote sensing data is not included in this).
24395	1	35	1	35	1	Difficult to see typo in Figure 1.3, therefore mentioned here. "tide guages" should be "tide gauges" [Martin Stendel, Denmark]	Accepted: thank you, correction made.
542	1	35	1	35	14	Do the horizontal blue lines on this figure for remote oberservations indicate the timespan of global coverage of each variable? They are not mentioned in the caption. [Jenna Pearson, United States of America]	Noted: Figure caption has been clarified so that it is clear that height of remove sensing bars is not related to data amount (unlike the other parameters).
32021	1	35	1	35	14	Add definition and explanation of "ECP" to caption. Also, spelling in figure "tide gauges". [Christian Reuten, Canada]	Accepted: Spelling error fixed, and ECPs replaced by "Extended RCPs"
1605	1	35	1	35	15	This figures is too busy and the top panel is fine, however, the bottom panels are hard to understand. Consider condensing the bottom observational data and remote sensing data. [Nora Richter, United States of America]	Noted: We have worked with TSU to improve clarity of the figure without removing important information.
15435	1	35	1	35	15	Fig. 1.3. the presence of a placeholder for CPR data is unclear? There are no other biological data series in the figure. If CPR data used then why not long records of fish and other animal abundance, distribution and exploitation? Perhaps see cited ref. By Milosavic et al. 2018. [EUCE, Belgium]	Noted. The CPR data are included in the final version of the figure as an illustrative example of a long biologial time-series (c.f. Edwards et al. 2010, Trends in ecology & evolution, 25(10), pp.602-610). We considered other datasets but chose the CPR since there are potential issues (i.e. which database to use, method used, etc.) for other datasets such as fish catch. We make it clear in the caption that this figure is only showing "illustrative examples"

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2411	1	35	1	36	16	Figure 1.3 only starts at 1800 AD. The chosen 200 year time interval is much too short to document pre-industrial natural variability. In the text you explain yourself, that the palaeoclimatologocal context is very important, yet, here you fail to show it in a transparent way. A few examples: Global glaciers were shrinking around the Medieval Climate Anomaly and then grew significantly towards the Little Ice Age (LIA). The LIA is not the starting point nor representative reference period of the pre-industrial time. It is misleading to show the LIA and claim that this represents the "pre-industrial climate". In fact the LIA was the coldest phase of the entire Holocene (maybe except the 8.2k event). Please sharpen your story here otherwise this could erode trust in the overall report when key relations are "swept under the carpet" and the LIA is misused and misrepresented as allegedly characteristic for the entire pre-industrial period. The global glacier evolution of the past 2000 years was presented by Solomina et al. 2016 (doi: 10.1016/j.quascirev.2016.04.008). How can a special report on the cryosphere NOT cite this key paper? Likewise, sea level was higher in Medieval times than during the LIA. See Kopp et al. 2016 (doi: 10.1073/pnas.1517056113) with their global sea level reconstruction of the past 2000 years. You cannot write a Special Report about the oceans without citing and discussing this key paper. [Sebastian Luening, Portugal]	Noted: These message are not able to be conveyed in this figure. The vertical bars show the time intervals used as standard reference intervals for IPCC assessments (CCB1). Text in CCB1 discusses the compromises that need to be made regarding "pre-industrial" for assessment reports. The figure shows arrows pointing forward and back to indicate data coverage beyond what is able to be represented on the time-scale of this figure.
314	1	35	2	35	14	You define RCP in the caption, but not ECP. [Ethan Kyzivat, United States of America]	Accepted: The text on the figure has been updated to "Extended RCPs"
30541	1	35	2	35	14	What about OBIS or fisheries data? [Hans-Otto Poertner and WGII TSU, Germany]	Rejected: The CPR data was chosen as an illustrative example after discussion about the potential limitations of different oceab biology datasets. OBIS would be a poor choice because it is an aggregate database from many sources, with contents collected in a variety of non-standardized ways, so no way to count up individual entries. Data sets on fisheries surveys or nationally reporting catches could be aggregated into a time series, but FAO would have to provide.
25949	1	35	2	35	2	Part about cryosphere is unclear: First line is sea ice extent, then ice mass, elevation, area. Do these variable to sea ice or land ice? This needs to be clearer Also the ice mass is not the most relevant quantity. It's the ice mass change. [Regine Hock, United States of America]	Noted: They refer to land ice. This has been clarified in SM1.4
25951	1	35	2	35	2	There are glacier length observations but glacier mass change observations which are more relevant are not mentioned, while for the ice sheets (remote sensing) a number of variables are distinguished. [Regine Hock, United States of America]	Noted: Glacier length observations are used as an illustrative example only. Chapter 2 will need to more specifically deal with different data sources relevant to their areas, possible by including an expanded version of this figure with datasets relevant to mountain cryosphere.

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28335	1	35	2	35	4	The figure caption would read better if some elements were moved to the Appendix, and to start with, all the refrences, and may be the exact calculation of the spatial coverage. A name should be given to each panel, (A) and (B) if nothing better ('this will help reading the Appendix). This will help to convey at this stage the main points. I would explain in a few words the color scale, " it gives the spatial coverage in percentage, from pale blue, sparce, to dark blue, more than 3/4..", leaving to the Appendix further details. [Anne GUILLAUME, France]	Noted: Figure caption has been revised with some information moved to SM1.4. We have worked with TSU to improve visuals.
17307	1	36	1	36	48	Indigenous Peoples have the right to self-determination (UNDRIP Article 3) and this includes self-determination in research. The current research paradigm is not one in which Indigenous self-determination is realized. This is important context for this section in particular. For more information see the National Inuit Strategy on Research (https://www.itk.ca/wp-content/uploads/2018/03/National-Inuit-Strategy-on-Research.pdf). Indigenous self-determination in research looks like more Indigenous governance in research strucutres and institutions, better ethical conduct of research, funding that is aligned with Indigenous priorities, ensuring Indigenous access, ownershi, and control over data and information, and building Indigneous research capacity. So to discuss IK in global assessments is only one small piece of the pie and the entire pie (ie. Indigenous self-determination in research) must be presented here to have meaningful discussion. Especially since this is a big discussion in Arctic research at the moment (see recent outcomes of the 2nd Arctic Science Ministerial - https://www.arcticscienceministerial.org/en/). The sentence on line 33-34 stating that "peer-reviewed research on IK and LK is burgeoning..." could be considered part of the problem, a violation of UNDRIP because doing research ON IK implies that it could be non-Indingeous scholars extracting this information from Indigenous communities and misinterpreting and misreprenting it. The language of "collecting IK and LK from knowledge holders " (line 45) can also be problematic. While this is certainly not always the case (there is some excellent research that engages appropriated with Indigenous communities and IK) and the problems and risks of which are noted further on in the section, it does indeed exist and has left a negative legacy. As the National Inuit Strategy on Research states in the introduction, "The relationship between Inuit and the research community is replete with examples of exploitation and racism. Research has largely functioned as a tool of colonialism," Indigenous Peoples, including Inuit who play a prominent role in the topic of this special report, are calling for change in research, and in Arctic research (which again features prominently in this report). This change includes the way global research assessments engage with Indigenous Knowledge. The Inuit Circumpolar Council asks the IPCC and the authors of this report to hear this call and respond with openness to exploring this change with us. [Joanna MacDonald, Canada]	Taken into account: Thank you for your excellent points. We have revised a sentnece here to accomodate to emphasize collaboration with all knowledge holders. Also your points are addressed in the CCB on IK & LK.

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	1	36	1	37	57	I feel extremely uncomfortable with the way this section seems to equate IK, LK and Scientific knowledge. I will return to this later, but a) it is not demonstrated that IK is more "flexible and adaptive in changing conditions" than more traditional knowledge (l.7, P. 36) , b) the cross chapter box does NOR demonstrate that IK and LK are unique sources of knowledge, it simply accepts they are (l.4, P. 37), c) it is wrong to give the impression that IK and Scientific Knowledge are like two eyes (e.g. equal, l. 16-17, P.37). Where is the validation, testing, etc. in IK? What would the IPCC report be if IK and LK without validation, testing and review was as important and scientific knowledge? This is undervaluing what science stands for [Manuel Barange, Italy]	Taken into Account: We have worked to clarify how scientific knowledge as a very different validation process that IK and LK. No we cannot compare them. They are of completely different systems of rigor. Scientific knowledge results from relicable, random-sampled, generalizable research approaches whereas IK and LK are not so. Our intent is not to say they are the same as science but to say they are different and equally important to overall understanding.
25953	1	36	1	39	18	The CC box is excellent but with another 2 pages on that topic (sec 1.8.2 and 1.8.3, there is a lot of repetition which should be avoided. Can the box be expanded to include some of the information not in the box and the main text greatly be reduced, while also deleting repetition? [Regine Hock, United States of America]	Taken into account: We have removed redundancies that were in the SOD for the FGD.
13777	1	36	1	41	40	6 pages are dedicated to indigenous and local knowledge (and a FAQ) while only 3 pages are dedicated to all other knowledge. Suggest this is rebalanced and shortened for concision. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected: There are 5 pages on scientific knowledge and 5 pages on two other knowledge systems combined (IK & LK). Also, considering that IPCC has been founded upon scientific knowledge from its beginning and we are in SROCC framing and formally introducing IK & LK fro the first time, it needs space.
10809	1	36	3	36	19	LK and IK. How relevant is this distinction? In the 1980s there was already a good deal of discussion about appropriate terminology (se e.g. Chambers 1983: 82-5) in the search for a single term, settling on rural people's knowledge to merge LK and LK. Again and again the text recognises the overlap by saying 'LK and IK'. If IK is to continue to be used, it would be desirable to define the difference from LK more clearly . But perhaps there are political reasons? [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: The distinction between IK and LK is highly relevant, as is clear in the glossary definitions of each and in our text and CCB. The literature of the 1980s predates the clarification of this difference, largely spurred by the increasing self-determination, land-claims and other rights that Indigenous groups are realizing, especially in the last 2 decades.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17299	1	36	5	36	7	The definition of Indigenous Knowledge used within the Arctic Council is: Indigenous Knowledge is a systematic way of thinking and knowing that is elaborated and applied to phenomena across biological, physical, cultural and linguistic systems. Indigenous Knowledge is owned by the holders of that knowledge, often collectively, and is uniquely expressed and transmitted through Indigenous languages. It is a body of knowledge generated through cultural practices, lived experiences including extensive and multigenerational observations, lessons and skills. It has been developed and verified over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. Much work has gone into coming to this definition with full consensus from all Arctic Council Permanent Participants (i.e. Indigenous organizations) and as the Arctic plays a central role in the topic of this report, it would be appropriate to use this definition. If that is not possible, at the very least the SROCC should reference the Arctic Council's Ottawa Indigenous Knowledge Principles document where this definition and additional information on Indigenous Knowledge can be found. [Joanna MacDonald, Canada]	Taken into consideration: We have worked to align the definition with the other special reports which also include a holistic definition applicable to the diversity of Indigneous people globally. We respect your community's work. Hwever we need to maintain the IPCC protocol which includes Indigenous groups of all ocean and cryosphere contexts.
18237	1	36	7	0		flexible and adaptive in present-day changing conditions'. This is a very definite statement and the use of some 'uncertainty' language could help. IK is flexible and adaptive except when it's not, or when it can not be due, to the abrupt changes taking place. See for example, the uncertainty on sea ice conditions in the Arctic which creates major risks for Indigenous hunters. Keeping in mind this as well as other similar examples, one could phrase this as, 'flexible and adaptive, to the extent possible to present-day changing conditions' [APECS Group Review, Germany]	Accepted: Good point! changed to: flexible and adaptive in changing conditions but increasingly challenged in the context of contemporary climate change.
17301	1	36	11	36	11	Change beginning of sentence to "IK and LK are TWO DIFFERENT ways of knowing that...". Furthermore, IK is also a body of knowledge, not just a way of knowing. There is great risk here in reducing IK to less than it is, and this is particularly of concern because the general IPCC audience will be unfamiliar or entirely unaware of Indigenous Knowledge. It is important, and consist with the principles of UNDRIP, that IK be presented by Indigenous Peoples rather than interpreted by non-Indigenous authors. Perhaps there is a way to introduce the term IK here but at the same time note that engaging with IK in IPCC reports requires Indigenous Knowledge holders in order to fully and appropriately communicate what IK is and to direct how IK can be utilized in this context. [Joanna MacDonald, Canada]	Accepted: As per your first points, we have changed the text to read 'two different'. As per your second comment, we believe we have addressed this throughout and especially with having the IPCC input in the CCB describing how to best engage other knowledge holders.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17303	1	36	11	36	16	With such a strong example for IK in this paragraph, it would be helpful to have an example of LK rather than the vague statement that it influences how people engage with climate change. Not really sure what that means. [Joanna MacDonald, Canada]	Accepted: We included an LK example to balance as you recommend.
17305	1	36	24	36	25	HOW have IK and LK have been explored in each chapter? Did they follow the same process? Do they explore it equally or do some explore it more? This is quite a blanket statement and a very tall order as, if done without the active partnership of Indigenous Peoples and the appropriate knowledge holders, this would not uphold the UN Declaration on the Rights of Indigenous Peoples. In UNDRIP, Article 31.1 states that "Indigenous peoples have the right to maintain control, protect and develop their cultural heritage, traditional knolwledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions." Other articles, including Article 13, also include rights that relate to the use of Indigenous Knowledge. The IPCC needs to work with Indigenous Peoples to explore a process by which to use Indigenous Knowledge in its assessment process. Considering the attention to Indigenous Knowledge in the SROCC, the IPCC should make a committement or recommendation to begin this work following this special report. [Joanna MacDonald, Canada]	Accepted: We have changed the word from 'explored' to 'cites examples of'
18257	1	36	27	36	40	1.8.2. I wonder if some short mention of the differences between national populations in belief of climate change would be worth mentioning. See, for example: Lorenzoni, I., & Pidgeon, N. F. (2006). Public views on climate change: European and USA perspectives. Climatic change, 77(1-2), 73-95. [APECS Group Review, Germany]	Taken into account: We haven't cited this reference, but we have expanded section 1.8.3 to give more recent information on public perceptions of climate change.
8743	1	36	28	36	30	Another reason would be that authors were more aware of IK and therefore referencing it more. [Nina Hunter, South Africa]	Taken into account: We appreciate your insight but our statement is about showing how references increased from AR4 to AR5 but not about explaining why.
30543	1	36	29	36	29	Do you mean in the AR or in the literature? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Changed to 'AR references . . .

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29161	1	36	45	36	46	After "....Roué et al., 2017, Roué and Molnar, 2017", it would be appropriate to add the reference to Lavrillier and Gabyshev 2017 - a 500 pages work-published after 5 years long participatory project with IP communities, co-written with Siberian reindeer herder, and documenting and explaining in English, Evenki and Russian this complexe Siberian Indigenous Knowledge system, with its indigenous typologies. This book also explains how herders-hunters use their own knowledge system for analysing climate change and related changes in biodiversity. (PS: the ful reference is already in the chapter - Lavrillier A. & S. Gabyshev, 2017 An Arctic Indigenous Knowledge System of Landscape, Climate, and Human interactions. Evenki Reindeer Herders and Hunters, Studies in Social and Cultural Anthropology, Kulturstiftung Sibirien, Fürstenberg/Havel, Germany 467p) [Alexandra LAVRILLIER, France]	Accepted: Moved to this new location from earlier in the text.
32865	1	36	52	39	10	It is extremly relevant to inlcude indigineous knowledge in this report on oceans and the cryosphere, where a relativley high percentage of human populations and communiites retain, rely upon, and produce indigineous knowledge. [Government of United States of America, United States of America]	Thank you.
17313	1	36	52	40	57	This is one of the most meaningful and innovative cross-chapter boxes to come out of IPCC. It is excellent and should remain in this form to carry the richness and importance of the messages within. This is the starting point for further work on IPCC engaging with new knowledge systems, particularly Indigenous Knowledge. In publishing this cross-chapter box, IPCC is recognizing the rights of Indigenous Peoples and this is very much in line with the UNFCCC which just moved forward in the development of the Local Communities and Indigenous Peoples platform at the most recent COP. There is certainly connections to be made there as this platform includes a focus on knowledge exchange. The Inuit Circumpolar Council commends the IPCC, and particularly the chapter authors, for including this important piece and, as noted, it is in line with ongoing international discussions such as at the UN, the Arctic Coucil, and in forums like the Arctic Science Ministerial. We hope that this is the beginning of a meaningful partnership that will pave the way for IK in global assessments and Indigenous self-determination in research more broadly. [Joanna MacDonald, Canada]	Thank you.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23035	1	37	0	39		"demonstrates" is not adequate. You are expected to provide an assessment, not a demonstration. Please reformulate (used twice in the same page). I find the box quite long. The figure may also convey the sense of assessment (confidence in strength), limits, challenges. The specificities of links to climate change ocean cryosphere may be developed in the visual representation that is very generic (biodiversity for case 2). References to be merged with those of chapter as done in SR15. [Valerie Masson-Delmotte, France]	Accepted: Several things changed here: We changed 'demonstrates' to 'assesses' and 'demonstratively' with 'clearly'; We are not sure what to say about the length- it is actually shorter than the other two CCB's in Ch 1 and wee feel that we are succinct in the important information we were tasked to cover and have taken away any information that is duplicated in the Chapter text. In terms of the visual representation of the various comings together of knowledge systems, we talk about ocean and cryosphere in the caption but out main intention in the figure is to visually represent the coming together of knowledge holders and the process that entails. Finally, yes the references are/will be merged with the chapter references.
16683	1	37	3	37	3	I suggest replacing "demonstrates how" by "introduces" or "shows", because this box is in no way a demonstration, rather a collection of general statements. [Samuel Morin, France]	Taken into account: Already changed as per comment 1062 above.
17311	1	37	7	37	7	Replace "utilized" with "recognized" here and "recognising" with "understanding" [Joanna MacDonald, Canada]	Accepted: Text revised.
32867	1	37	7	37	7	This line overstates what is actually in the report: "Indigineous knowledge and local knowledge are utilised throughout SROCC." This is simply not true and the sentence should be removed from Cross-Chaper Box 3, which is otherwise is well done. [Government of United States of America, United States of America]	Taken into account: Already changed as per comment 1062 above.
17309	1	37	8	37	8	Include "Indigenous Peoples and" before "local communities" in this sentence. [Joanna MacDonald, Canada]	Accepted: Text revised
16685	1	37	11	37	11	I don't understand the sence of the word "demonstratively" here. [Samuel Morin, France]	Taken into account: Already changed as per comment 1062 above.
18223	1	37	12	0	14	It would help to mention roughly when this happened, e.g. in the 1980s. It is worth considering other citations too, such as from NOAA for example to suppllement the Huntington (2000) Ecological applications paper. If deemed necessary consider including earlier citations as well. The section in the Huntington (2000) paper draws from previous papers of the author, some later 1990s citations and "personal communication". Therefore additional citations, if available, can benefit the text here. [APECS Group Review, Germany]	Accepted: We added dates 1977 and 1980 and also added another citation as suggested.
18225	1	37	12	0	14	One needs to clarify what TEK (Traditional Ecological Knowledge), IK and LK mean and the relationships/differences between those. Provide consistent definitions (with the references cited) or expain (in some footnote if needed) whether there are synonyms. For example the Huntigton (2000) paper refers to the bowhead whales underestimation case as TEK instead of IK; provide relevant clarifications in the text. See also for differences and similarities between IK and TEK Dudgeon, R. C., & Berkes, F. (2003). Local understandings of the land: Traditional Ecological Knowledge and indigenous knowledge. In Nature Across Cultures (pp. 75-96). Springer, Dordrecht. [APECS Group Review, Germany]	Rejected: We aren't using TEK in SROCC (and other recent global assessments also are not) and we classified articles talking about TEK as IK... The references to TEK are old and don't reflect the current, more global thinking now.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16687	1	37	13	37	14	I don't understand the logic here. IKLK is claimed to have been used to address issues with the total population of a whale species which was suspected to be underestimated, and then IKLK demonstrates that the population is stable. This says in no way whether the population was underestimated or overestimated, all it says is that the number is steady in time. This probably needs reformulation, or choose a more convincing example. [Samuel Morin, France]	Accepted: We have revised the text so it is clear.
8745	1	37	16	37	17	Should 'knowledges' not be 'knowledge'? Compare to 1-38 line 19 where it is written in the singular. IK and LK is also not plural. [Nina Hunter, South Africa]	Rejected: This is a direct quote and so we are unable to change the wording.
16689	1	37	19	37	19	"(ibid:334)" : this does not seem to follow SROCC formatting guidelines for references. [Samuel Morin, France]	Accepted: Changed 'ibid' to Bartlett
30549	1	37	26	37	26	Clarify cross-reference, probably relating to 5.5.3.2.1. [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account: However, the chapters have changed substantially and all cross chapter references have been updated and now the reference for chapter 5 for that sentence is 5.2.3
13779	1	37	44	37	53	It was unclear from the text how IK and LK link to Locally Managed Marine Protected Areas (LMMAs). This could helpfully be clarified to make the case study more valuable. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted: changed from: 'use local management systems' to: 'use local knowledge for management systems'
16691	1	37	47	37	47	"proliferate" : to me there is some negative judgement in this wording. Is it the intention of the author team ? [Samuel Morin, France]	Accepted: changed to: Today's norm is a hybrid system of Locally Managed Marine Protected Areas (LMMAs),
30551	1	37	48	37	50	Needs to be specific on adaptation and mitigation benefits. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: revised sentence to read: The expected benefits support climate change adaptation {Roberts, 2017 #654} and potentially mitigation through improved carbon storage {Vierros, 2017 #653}.
16693	1	37	49	37	49	"(ibid)" : this does not seem to follow SROCC formatting guidelines for references. [Samuel Morin, France]	Taken into account: However the sentence is gone and so no longer applies.
18227	1	37	50	0	53	This sentence needs to be rephrased for clarity; especially the part of non-compliance with LMMA regulations [APECS Group Review, Germany]	Accepted: We restructured the sentence for clarity.
9487	1	37	50	37	53	This last sentence is barely understandable, we suggest to rephrase and clarify it. [Government of France, France]	Accepted: We restructured the sentence for clarity.
13781	1	37	52	37	52	What does the 'non-compliance' with LMMA regulations refer to? Are there brief examples to add here? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted: Text no longer exists.
18253	1	37	55	37	55	Cross-Chapter Box 3: "Polynya" should probably be briefly defined. [APECS Group Review, Germany]	Accepted: We included a brief definition in the sentence, 'Open water surrounded by ice'
18255	1	38	3	38	6	What has been the response to these recommendations? [APECS Group Review, Germany]	Taken into Account: However we do not have the space here to describe this aspect.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16695	1	38	8	38	12	The example shown here is irrelevant. It is well known that IKLK is useful for managing natural hazards in mountainous regions (avalanche danger management in Switzerland and Austria is now even on the UNESCO Intangible Heritage list since December 2018) but this says nothing about climate change-related knowledge and whether IKLK can be used to assess past changes in this context. Unless a more convincing description is found, I think this paragraph cannot stay in this Box. [Samuel Morin, France]	Accepted: New case has been inserted to replace former case.
8747	1	38	23	38	44	Perspectives from the Himalayas' is in the third person and 'Perspectives from the ICC Canada' is in the first person. Suggest consistency between sections. [Nina Hunter, South Africa]	Accepted: Changed to 3rd person
18229	1	38	33	0	36	These sentences need to be in quotations or re-written in passive voice. See 'our Inuit knowledge and priorities guide research' and also 'ensures that our knowledge is...''. Who is we? The ICC is saying that? If so clarify. The rest of the pragraph is in passive voice, so the paragraph could benefit from being consistent in terms of whether these are direct statements from the ICC or this is someone describing those. [APECS Group Review, Germany]	Accepted: Changed to 3rd person
30515	1	38	33	38	44	This paragraph is – in contract to the rest of the chapter/report – written from a personal perspective: our knowledge, our homeland, we incentive, our perspective; I strongly recommend adapting the style to the rest of the chapter/report. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Changed to 3rd person
30553	1	38	33	38	44	Avoid first person language [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Changed to 3rd person
32023	1	38	37	38	39	Something broke towards the end of that sentence. [Christian Reuten, Canada]	Accepted: changed to "and lead approaches to address climate challenges with great incentive to develop innovative solutions. "
8749	1	38	39	0		as we great incentive' - does not make sense, please make clear [Nina Hunter, South Africa]	Accepted: changed to "and lead approaches to address climate challenges with great incentive to develop innovative solutions. "
24335	1	38	39	38	39	The phrasing "as we great incentive" is unclear. [Philippus Wester, Netherlands]	Accepted: changed to "and lead approaches to address climate challenges with great incentive to develop innovative solutions. "
16697	1	38	42	38	42	The meaning of "our" in this statement is unclear and should be made more explicit. [Samuel Morin, France]	Accepted: changed ot 'Inuit'
8751	1	38	44	0		presentation' should be plural [Nina Hunter, South Africa]	Accepted: changed to 'the presentation of results.'
23903	1	39	0	39	0	In Cross-Chapter Box 3, Figure 1, there does not seem to be a clear explanation for the abbreviation for SK, which is implied to be scientific knowledge, although both IK and LK are explained in the text. Additional clarification would seem to be needed. [Government of Japan, Japan]	Taken into Consideration: We no longer use the abbreviations in this place
8753	1	39	0	0		Under case#1 - remove 'needed'; under case#2, final sentence - 'warning' not 'waring' [Nina Hunter, South Africa]	Taken into Consideration: We no longer use the original caption so request not applicable anymore.
8755	1	39	0	0		Where 'example' is stated - e.g. "IK, LK, and SK example in the Pacific" at start of each case, I recommend using colon or hyphen to separate this information from what follows; Under case#3 suggest removal of 'to make decisions' in order to make it read better [Nina Hunter, South Africa]	Taken into Consideration: We no longer use the original caption so request not applicable anymore.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25395	1	39	0	0		SK (I presume it is scientific knowledge) is not defined in fig or text as SK. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Taken into Consideration: We no longer use the abbreviations
4287	1	39	0	39		Following on the above comment, to say that IK, LK and SK are three equal contributors to a knowledge braid is a terrible message to send to the community and to policymakers. So, if they only use LK and IK they get 2/3 of the best knowledge, so why funding science then? IK and LK are sometimes very useful, sometimes are so biased that are useless. Only SK has the ability to assess the value of the different sources of knowledge [Manuel Barange, Italy]	Accepted: A new figure has been developed to address these issues.
4979	1	39	0	39		In example 2 Case #2 Cross-Chapter Box 3, Figure 1, change "waring" to "warning" [Debra Roberts and Durban Team, South Africa]	Taken into Consideration: We no longer use the caption
22221	1	39	0	39		Cross-Chapter Box 3, Figure 1: This is a beautiful and eye/catching figure, but its message seems so trivial that it becomes useless. [Sergio Henrique Faria, Spain]	Accepted: A new figure has been developed to address these issues.
1389	1	39	1	0		While I assume 'SK' stands for Scientific Knowledge I cannot find where in the text "SK" is officially given that designation. Additionally, 'SK','LK' and 'IK' should all probably be defined in the caption, for those who will jump to the figures and not read the text. [Jacinta Clay, United States of America]	Accepted: In the new caption for the new figure we only use the complete spelling for each of the three knowledge systems.
1393	1	39	1	0		The amount of whitespace on the edges could be reduced, though perhaps that's just a function of how it is typeset now. [Jacinta Clay, United States of America]	Taken into account: We think so-- the IPCC report will look very different indeed
10811	1	39	1	39	10	The braiding diagram and imagery - part 1. Like SK, LK and IK are continuously evolving and changing. Knowledges or knowledge systems also interact with and are strengthened by other knowledges. They can be seen then as processes as well as transient stocks. The braiding image takes us some way but is additive not mutually and interactively evolving. The use of the word hybrid is step in the right direction but does not go as far as current good practice in participatory action research. There is a considerable literature on PAR - participatory action research (see for instance Bradbury 2008) and a rich repertoire of approaches and methods (over 25 detailed in Buckles and Chevalier (2019). This is a frontier which those who work on and live in the cryosphere would seem especially well placed to explore with scientists and vice versa with mutual win-wins. [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Thank you and yes we added a sentence on co production and also reflect this process in the new figure.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
10813	1	39	1	39	10	The braiding diagram and imagery - part 2. Earlier the language used to describe these collaborative and interactive processes was building knowledge and co-construction, with their physical imagery. This has been superseded in much discourse by concepts like co-evolving and even negotiating (Guijt 2007), for instance the collaborative identification of indicators for continuous observation by those who live in a locality. This more organic and evolutionary approach goes beyond any concept of additive and complementary stocks of knowledge. It opens the door to combining participatory time series monitoring with continuous learning and adaptation (For the power of participatory statistics, with their own rigour and amenable to statistical analysis, see Holland (2013)). New knowledge is co-generated going beyond what LK, IK or SK could have learnt on their own. [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Thank you and yes we added a sentence on co production and also reflect this process in the new figure.
10815	1	39	1	39	10	The braiding diagram and imagery - part 3. The whole is then much more than the sum of its LK, IK and SK parts, as these interact and evolve. The question has been asked, for instance, whose indicators count? Whose monitoring? And do indicators need themselves to evolve as conditions and insights change? Thus for instance with the Inuit the methodologies used for monitoring, the indicators, and who assesses changes, could be, perhaps have been, negotiated and evolved interactively between Inuit and scientists. If so, it would be fitting to acknowledge this, and the braiding imagery should be abandoned or modified. [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Thank you and yes we added a sentence on co production and also reflect this process in the new figure.
10817	1	39	1	39	10	The braiding diagram and imagery - part 4. References: Bradbury, H. (2008) the Sage Handbook of Action Research, Sage Publications, Thousand Islands, London , and Delhi Chambers, R. (1983) Rural Development: putting the last first, Longman, Harlow, UK Chevalier, J.M. and Buckles, D. J. (in press 2019) Participatory Action Research: Theory and Methods for Engaged Inquiry. 2nd edn., Routledge, UK. Guijt, Irene (2007) Negotiated Learning: collaborative monitoring in forest resource management, Resources for the Future, Washington DC Holland, J. (2013) Who Counts? The power of participatory statistics, Practical Action Publications [robert chambers, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Thank you and yes we added a sentence on co production and also reflect this process in the new figure.
30517	1	39	1	39	10	Explain (again) in figure caption what IK, LK and SK stand for [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: A new figure has been developed to address these issues.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28337	1	39	1	39	2	I like the idea, but to me the three braids shown in the box "case studies" carry the same strength, as they have the same number of threads, 3, and visually I even feel the one in one color (the one with one knowledge) stronger than the other two. I would suggest to shorten the title of the cases shorter without repeating IK, LK, SK, example "with one knowledge system", "with two...", "with 3...". and write in full the first three occurences of IK, LK et SK in case#1 with in brackets (IK)... [Anne GUILLAUME, France]	Accepted: A new figure has been developed to address these issues.
24397	1	39	2	39	2	Cross-chapter box 3, Figure 1: I assume that SK stands for "scientific knowledge", but the abbreviation is not explained in the box. [Martin Stendel, Denmark]	Taken into Account: We no longer use the abbreviations in the caption
1391	1	39	4	0	10	This figure caption could be shortened to one/two sentences and contain the same information. The metaphor is powerful enough to stand mostly by it's own. [Jacinta Clay, United States of America]	Taken into Account: We have developed a new figure that we feel requires the expalantions in the caption.
16779	1	39	4	39	10	While the Box is about IKLK, this figure is about the use of multiple knowledge systems. Therefore, this figure would make a potentially useful addition to section 1.8.3 "Utilising Scientific Knowledge, Indigenous Knowledge, and Local Knowledge" but is actually irrelevant to the CCB3 and should be removed from it. [Samuel Morin, France]	Rejected: The box is about using all three knowledge systems and the figure illustrates it and is in the correct place.
29779	1	39	4	39	10	In figure legend, please specify what the knowledgesystems A,B and C stand forand explain the abbreviations SK, LK, IK. Is A=SK, B=LK, C=IK? If so, consider substituting A,B,C with SK, LK, IK. [Dorte Krause-Jensen, Denmark]	Taken into Account: We no longer use the abbreviations in the caption
25955	1	39	4	39	4	I am not sure what this figure really contributes. Case studies are simply repeated in a more condensed way and the graphics don't really add much actual information. The figure is not a very efficient use of space. (Alternatively the case studies are entirely absorbed into this figure, thus eliminating the repetition in the main text.) [Regine Hock, United States of America]	Taken into Account: We have created a new figure to communictae the temporal process.
25957	1	39	4	39	4	All acronyms should be spelled out somewhere so that the box stands for itself [Regine Hock, United States of America]	Taken into Account: We no longer use the abbreviations in the caption
8757	1	39	5	0		Remove 'can' before 'work' to let it read better. [Nina Hunter, South Africa]	Taken into account: We have new figure and new caption without these words.
1395	1	39	14	0	57	The inconsistent hyperlinks seem like a rollover from an early draft, though I won't question if that's the process of citation for the IPCC. [Jacinta Clay, United States of America]	Taken into account: All references have been moved to end of Chapter 1
4289	1	41	0	41		Again, section 1.8.3. equates the three sources of knowledge, even though IK and LK are not put through any validation processes as SK goes through. IK and LK is all we had before science transformed our view of the world. Without it the Earth would be considered flat and the anger of the gods would be responsibe for volvanic activity, ice loss, etc. How can the IPCC consider the three sources of knowledge are equivalent? [Manuel Barange, Italy]	Taken into Account: We clarify that each knowledge system is rigorous (farther down in CCB), we talk abut each system's rigor -- second paragraph of 1.8.3: Conceptual frameworks guiding utilisation of different knowledge systems acknowledge each as rigorous validand, useful. Therefore we are by no means equating them as equivalent-- in fact their differences are part of why they work well together.
23037	1	41	0	41		Education, social learning, knowledge co design and co production could be covered here (1.8.3). [Valerie Masson-Delmotte, France]	Accepted: These topics are now addressed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18211	1	41	3	0		Utilising multiple ways of knowing...''. This needs to be specified or rephrased. Ways of knowing what? Might as well rephrase to something along the lines of ''Utilising multiple ways of acquiring knowledge on ..(e.g. ecosystems)'' [APECS Group Review, Germany]	Accepted: YES and thank you-- we changed 'ways of knowing' to 'knowledge systems'
8759	1	41	5	0		each' should be 'one' as there are more than two forms of knowledge [Nina Hunter, South Africa]	Accepted: YES thank you-- changed 'each other' to 'one another'
25959	1	41	6	41	6	why only climate data? You mean 'scientific observations'? [Regine Hock, United States of America]	Accepted: We changed to 'quantitative'.
82	1	41	11	41	11	"Valid" is not a word I would use here based on its ontological implications, "useful" is better on its own. I object to the use of "valid" even in describing climate models, as all models are by nature not the same as nature. [Baylor Fox-Kemper, United States of America]	Accepted: YES thank you and good point-- we changed 'valid' to 'rigorous'
8761	1	41	16	0		Suggest inserting 'it can involve' before 'working' to make meaning clearer [Nina Hunter, South Africa]	Accepted: Revised accordingly.
18213	1	41	19	0		Working across disciplines (interdisciplinarity) - this is slightly problematic as working across disciplines would more likely be called Crossdisciplinarity. Also the Klenk and Meehan (2015) citation, if this stays as is, looks inappropriate in this context since the authors discuss mostly trandisciplinary science in their paper rather than interdisciplinary science. Interdisciplinary refers to the process of integrating knowledge and methods from different disciplines, using a real synthesis of approaches. See Stember, M. (1991). Advancing the social sciences through the interdisciplinary enterprise. The Social Science Journal, 28(1), 1-14. as well as other web sources, such as the ones available from Jensenius R.A http://www.arj.no/2012/03/12/disciplinarities-2/ that provides a short and concise explanation of those concepts. [APECS Group Review, Germany]	Accepted: Thank you yes-- moved in a reference focused on interdisciplinary and moved Klenk into transdisciplinary position.
17315	1	41	20	41	20	Include "Indigenous Peoples" in this list of stakeholders. [Joanna MacDonald, Canada]	Accepted: Yes and thank you-- we have added 'Indigenous Peoples'
8763	1	41	21	0		The word 'across' is unnecessary as the word 'bridge' is sufficient [Nina Hunter, South Africa]	Accepted: Revised accordingly.
18215	1	41	21	0		The Burnham et al., 2016 citation looks like a paper poorly cited to be used in the IPCC report. In addition to that, it mentions nothing about trandisciplinarity [APECS Group Review, Germany]	Accepted: Yes, Good point- we removed Burnham from here and replaced in 1st paragraph on mixed methods where it is highly relevant
3493	1	41	24	41	24	Considering adding the word "formally" in front of "educated" to further recognize ways of knowing are different and unique. [Katherine Bishop-Williams, Canada]	Accepted: Revised accordingly.
18217	1	41	27	0		Diverse ways of knowing..'' Needs to be rephrased to something along the lines of ''Diverse ways of acquiring knowledge or understanding (of e.g. local ecosystems or ecosystem trends and changes)'' [APECS Group Review, Germany]	Accepted: This wording has been removed in revising the paragraph on education and climate literacy.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
13185	1	41	27	0	40	This parapgraph on education (ed) is most welcome. However, I regret that it is so short. The small space given over to ed is more than suprising, esp given that you say "Education has the strongest effect on raising climate change awareness". If anything, the underlying, long-term, deep, objectuive of the SROCC should be to make people aware of CC. So, I urge you to expand the ed paragrpah into a whole section or sub-section, for example: 1.9 Educating the public in climate change. [David Crookall, France]	Accepted: Thank you. We don't have the space to expand this section greatly but we have strengthened the text here and the overall focus of section 1.8.3. Education will also be picked up more thoroughly in AR6.
25399	1	41	27	41	27	climate literacy – implies this is gaining scientific knowledge – if it is about SK and IK and LK then all those who are climate literate need to appreciate different forms of knowledge, including scientists. Maybe the last sentences could be something like: “Thus, the availability and provision of scientific data regarding climate change are not sufficient to promote climate action. Recognition and integration of multiple knowledge systems are necessary to benefit from perspectives and skills of individuals, communities and practitioners and to engage them in climate action to derive effective local and global responses to the existential threats posed by climate change”. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted: The text the reviewer asks to be revised no longer exists due to extensive revisions.
13149	1	41	27	41	40	Working across disciplines (interdisciplinarity) - this is slightly problematic as working across disciplines would more likely be called Crossdisciplinarity. Also the Klenk and Meehan (2015) citation, if this stays as is, looks inappropriate in this context since the authors discuss mostly trandisciplinary science in their paper rather than interdisciplinary science. Interdisciplinary refers to the process of integrating knowledge and methods from different disciplines, using a real synthesis of approaches. See Stember, M. (1991). Advancing the social sciences through the interdisciplinary enterprise. The Social Science Journal, 28(1), 1-14. as well as other web sources, such as the ones available from Jensenius R.A http://www.arj.no/2012/03/12/disciplinarities-2/ that provides a short and concise explanation of those concepts. [David Crookall, France]	Accepted: Edits and rearranging of text have proceeded in order to address this reviewer's concerns.
25397	1	41	27	41	40	behaviour change will be required to mitigate and adapt Lines 34-35 this aspect of values and worldviews is critical and should be emphasised more widely in other sections – this would help address some of my overall comments [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Section 1.8.3 has extensive revisions to address these concerns. Also the overall discussion and CCB of IK and LK addresses the reviewer's concerns about values and worldviews.
18219	1	41	30	0		Could benefit from specifying the following ''humanity’s role''. So the question here would be humanity's role in what? Humanity's role in exacerbating climate change, in alleviating climate change or what? [APECS Group Review, Germany]	Accepted: text has been revised to "humanity's role in both causing and abating climate change..."
8765	1	41	36	0		Suggest replace 'their acceptibility of' with 'how acceptable they find' [Nina Hunter, South Africa]	Accepted: this suggested revision has been made.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
18221	1	41	38	0	39	The following is phrased in an unclear way that is likely to create confusions for the readers ''sensitivity to communities and their use of multiple knowledge systems''. Sensitivity to communities in terms of what? Taking into consideration their input in scientific assessments? If so, specify as such. Also ''their use''; phrasing can be improved since it's not clear who their refers to. [APECS Group Review, Germany]	Accepted: Changed sentence for clarity to: "Enabling these changes at a meaningful societal scale requires understanding communities' knowledge system use and utilizing multiple knowledge systems to best motivate effective responses to the threats and opportunities posed by climate change."
2199	1	41	38	41	40	As mentioned by Donner and Webber (2014) "culturally appropriate planning horizons" should be considered. On a global scale the sustainable development horizon from 2000-2030 (MDGs and SDGs) could be an example. The planning horizon for regions and smaller entities would be much more variable. [Poh Poh Wong, Singapore]	Noted: Thank you for your comment. However the sentence you refer to now is embedded in a new context and not in a final place where your suggestion would have made sense to add.
26287	1	41	43	44	20	This comment is for all the drafts currently being developed either in SRs or by the WGs. I note that the text describing essentially the same topics (time scales, scenarios, methodologies with respect to literature, communication of certainty) are presented somewhat differently by the different report teams. Some are better presented than others. I suggest that there be some common standard common text across all of the IPCC drafting teams with additional paragraphs being added for clarification or for the specific approach of the different SRs or WGs. It is disconcerting to see the different text and figures being presented for essentially the same thing. [Zelina Ibrahim, Malaysia]	Accepted. Now section 1.9.1 is a cross-chapter box with more authors from other chapters and also other reports involved. This ensures the consistency among IPCC reports.
30519	1	41	43	44	20	Using active voice “SROCC assesses”, "SROCC uses", etc, sound weird; suggest “In SROCC…are assessed/used, etc.” [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. Texts revised where possible.
30521	1	41	45	43	20	Can content of 1.9.1 or part of it be summarized in a table instead of text? Might provide a better overview. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. Tables are included in cross-chapter box 1
25961	1	41	49	41	49	hours instead of 'days' is more appropriate (e.g. glacier runoff, floods …) [Regine Hock, United States of America]	Noted. These texts are removed from SROCC.
18285	1	41	51	41	53	Please specify if the terms "local", "regional" and "continental" belong to the calibrated IPCC language, i.e. if using these terms within SROCC always refers to the scales given here (the climate models described in the next sentence being the only exceptions). [APECS Group Review, Germany]	Noted. These texts are removed from SROCC.
23039	1	42	0	42		There is a need to have a clear table showing when a certain level of warming is reached for a given scenario, so as to link RCP scenario, time horizon, and levels of warming. This exists in the appendix of chapter 3 for SR15 and could be expanded here. [Valerie Masson-Delmotte, France]	Accepted. Tables are included in cross-chapter box 1

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2413	1	42	1	42	13	I am surprised you chose to ignore my comment on the FOD. Once again: The chosen reference period 1850-1900 is assumed by the chapter authors to “approximate ‘pre–industrial’ conditions”. This assumption is incorrect. The pre-industrial climate of the past 10,000 years has been characterized by significant natural variability, including an alternation of marked warm and cold phases. A thorough review of past temperatures shows that the temperature level reached during the interval 1940-1970 serves as a better reference level as it appears to roughly correspond to the average pre-industrial temperature of the past two millennia. See Lüning & Vahrenholt 2017 (doi: 10.3389/feart.2017.00104). On an even longer timescale of the past 10,000 years, the Holocene average temperature corresponds to the temperatures reached 1970-2000 (Lüning & Vahrenholt 2017). It is therefore incorrect to state, the period 1850-1900 corresponds to average pre-industrial conditions. [Sebastian Luening, Portugal]	Taken into account. We fully agree with the deficiency of using 1850-1900 baseline. But the SROCC's choice of 1850-1900 is consistent with AR5, 1.5degree special report, and also the upcoming AR6 report. We explicitly state in SROCC and also other reports that this choice is a "trade-off".
28451	1	42	1	42	45	It is not clear why the IPCC limits itself to 2100. For many ocean and cryosphere impacts, the impacts are going to unfold way beyond 2100. In several recent papers, 2300 has emerged a useful additional time frame. Please provide information for 2300 as well. [Government of Saint Lucia, Saint Lucia]	Agreed. In some cases, for instance sea level projection, SROCC extends beyond 2100 to 2300 (chapter 4). This is stated in cross-chapter box 1.
18287	1	42	5	42	6	Allen et al. is not the official reference of the SR1.5, it should be IPCC, 2018. [APECS Group Review, Germany]	Agreed. Reference Updated.
29781	1	42	6	43	56	I wonder why l 6 says 1850-1900 as the preindistrial baseline while l. 54 says 1750. L 56. Why does SR1.5 represent 2.5-3 W m-2 when there is a correspondence between numbers for SR and W in other scenarios? [Dorte Krause-Jensen, Denmark]	Noted. SROCC used 1850-1900 as the pre-industrial baseline, to be consistent with 1.5°C report and upcoming AR6 report.
30545	1	42	7	42	7	Rather than saying not ideal, suggest say ‘noting that…’ [Hans-Otto Poertner and WGII TSU, Germany]	Agreed. Changes made.
18289	1	42	7	42	9	The literature cited does not state that "major volcanic eruptions during 1850-1900" have an effect on baseline values. Hawkins et al., 2017, only states the importance of the choice of a baseline period. [APECS Group Review, Germany]	Taken into account. The texts now are rewritten substaintially and now in Cross-chapter box 1. The discussions on "volcanic eruptions" are removed in the new version due to the length limit.
10477	1	42	15	42	26	The definition of the present period as being 2006-2015 is reasonable enough, especially when considering the slow time scales and integrative nature of much ocean and cryosphere change, especially for global quantities. However, there is much decadal variability is some aspects, such as ocean heat content uptake, or regional sea level rise. PAtterns of variation such as the PDO and AMO have a significant fingerprint on the scale of a few decades, hence I am a little unhappy with the use of a 10-year baseline. The 20 years 1996-2015 may be a more robust choice. [James Renwick, New Zealand]	Taken into account. We fully agree with the deficiency of using 2006-2015 baseline. But the SROCC's choice is consistent with 1.5degree special report and the upcoming AR6 report. This period incorporates most comprehensive ocean and cryosphere data, for example Argo-data since 2005 (providing near-global ocea data coverage at upper 2000m)
17031	1	42	17	0		why not update the analysis to 2006-2017? [Jorge Carrasco, Chile]	Taken into account. This choice is consistent with the upcoming AR6 report, agreed by all authors.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4341	1	42	21	42	21	I would be probably be more cautious here. Clearly internal variability will be smaller for global sea level rise or ocean heat content changes, but not for regional-to-local changes in NPP, O2, etc,.. [The UBern Team Group Review, Switzerland]	Taken into account. We fully agree with the deficiency of using 2006-2015 baseline. But the SROCC's choice is consistent with 1.5degree special report and the upcoming AR6 report. This period incorporates most comprehensive ocean and cryosphere data, for example Argo-data since 2005 (providing near-global ocea data coverage at upper 2000m)
18265	1	42	21	42	22	The double “compared to … compared to … “ structure of this sentence makes it hard to follow. I recommend rephrasing along the lines of “However, at this decadal scale the bias in the ‘present day’ interval due to natural variability will generally be small compared to differences between ‘present day’ conditions and the ‘pre-industrial’ baseline.” [APECS Group Review, Germany]	Accepted. Changes made.
3401	1	42	21	42	23	Reference? This is a significant factual statement with no citation or evidence directly referenced. [Patrick Orenstein, United States of America]	Accepted. This statement was removed.
22707	1	42	27	43	20	Please include some reflections here on the new RCP1.9 pathways too, as they will be relevant for the AR6 (and for understanding the difference between 1.5°C and 2°C). [Greeenpeace Group Review, Republic of Korea]	Accepted. RCP1.9 was included.
10479	1	42	28	42	34	I understand the "end of century" period (2081-2100) being used, as it is consistent with earlier reports. However, the beginning of that period is not much more than 60 years away now. I would like to see century-scale change considered explicit as well, so 2111-2130 for instance. Such an approach is used by the NZ Ministry for the Environment when presenting sa level rise and coastal hazard scenarios. This is important from a resilience viewpoint, given long planning horizons and lifetimes of coastal infrastructure, for instance. [James Renwick, New Zealand]	Taken into account. But this choice is consistent with the AR5, SR1.5, and upcoming AR6 report, agreed by all authors.
26317	1	42	28	42	34	It is not clear from this section what the “model evidence” is for changes beyond the end of the century. What proportion of the CMIP models continue long enough to describe potential future equilibrium changes? If this is model evidence, it should be clarified where that evidence comes from, or if it is a combination of model evidence and process-based understanding, that should be noted here as well. [Ethan Pierce, United States of America]	Taken into account. The text was removed.
1397	1	42	30	0		I had to google SDGs to learn what they were (though I had an inference). Since it is just used as an example, the whole example could be deleted/replaced, or the words written out, or the term described, all of which would make the sentence more clear and intuitive. [Jacinta Clay, United States of America]	Accepted. We decided to remove SDG here, make our section (now cross-chapter box 1) focusing more on timelines and scenarios.
8767	1	42	30	0		It would be useful to know what the timeframe is for the SDGs, perhaps inserted in parentheses here? [Nina Hunter, South Africa]	Taken into account. We decided to remove SDG here, make our section (now cross-chapter box 1) focusing more on timelines and scenarios.
29025	1	42	31	42	34	Add, due to relevance of paleo record, "…also considers paleoclimactic and model evidence for 'long-term' changes…". [Pam Pearson, Sweden]	Taken into account. The relevent text has been removed because of the length limitation.
10297	1	42	36	42	36	avoid using abbreviation (ToE) and spell it out, as it is used only twice in this Chapter [Yukiko Hirabayashi, Japan]	Taken into account. The relevent text has been removed because of the length limitation.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5251	1	42	36	42	45	These aspects of timeframes and ToE (Time of Emergence) need more literature revision (and more actual not only of 2012 and 2013 that is the moment of AR5) and more analysis and discussion. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account. The relevent text has been removed because of the length limitation.
1399	1	42	37	0		If "inhomogenous records" refer to the relationship defined by underlying differential equation, then it is perhaps outside of the scope for the framing and context. If it is just describing disharmonious data, than maybe the term is more academic than necessary. Would nonuniform or inconsistent be equally appropriate? [Jacinta Clay, United States of America]	Accepted. the relevent texts were replaced by a new sentence "the scarcity of reliable ocean and cryosphere observations represents a major challenge....."
18291	1	42	39	42	40	"although more consistency in approach is possible" - This part of the sentence is unclear, possibly missing a word? [APECS Group Review, Germany]	Taken into account. The relevent text has been removed because of the length limitation.
1401	1	42	40	0		Time of Emergence (ToE) is not in the glossary. Additionally, it is only mentioned in Chapters 1 and 6. Perhaps this paragraph on ToE should be deleted or shortened and the term be introduced in Chapter 6. [Jacinta Clay, United States of America]	Taken into account. The relevent text has been removed because of the length limitation. ToE was also added to the Glossary.
4343	1	42	40	42	40	The abbreviation ToE should be introduced earlier in the chapter. [The UBern Team Group Review, Switzerland]	Taken into account. The relevent text has been removed because of the length limitation. ToE was also added to the Glossary.
25963	1	42	40	42	44	delete ToE. Avoid acronyms. This one only occurs another 2 times in the same paragraph. Spell out or rephrase (e.g the second time it can simply be deleted; the context is clear. [Regine Hock, United States of America]	Taken into account. The relevent text has been removed because of the length limitation. ToE was also added to the Glossary.
1403	1	42	47	43	20	Since this is such an important part of the framing and context for the entire report perhaps there should be a figure to go with this section. As it is, all the numbers in succession are somewhat overwhelming. [Jacinta Clay, United States of America]	Accepted. We further rewrite/simplify the texts, and also include two tables.
16261	1	42	47	43	20	Here, the SSPs are introduced as complementary scenarios/pathways for the RCPs. However, the relevant chapter assessments are hardly covering SSPs based research. Please make sure to coordinate with the corresponding chapter authors (eg Chapter 4) to frame the SROCC scenario space in a way that reflects the specific chapter assessments. [Alexander Nauels, Germany]	Accepted. We have coordinate with other chapters via a cross-chapter box. SSPs are very brieflly introduced as they are not heavily used.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14919	1	42	47	43	9	The SR1.5 relied on the new RCP1.9 to examine the full range of the PA temperature goals, i.e.. limiting warming to 1.5°C. This paragraph does not even mention RCP1.9, and postulates that RCP2.6 was "the pathway considered most compatible with the PA goal…" but "would require implementation of not-yet-possible NETs…". Please revise the language to include RCP1.9 and a rationale for why it is not being considered in this report. Please revise the language concerning NETs: "not-yet-possible" is simply wrong for BECCS and DAC, and very clearly for reforestation. "not yet proven at scale and subject to considerable sustainability and feasibility constraints" might be a more appropriate wording. The SR1.5 provides an extensive analysis of feasibility and sustainability of CDR technologies, as does the upcoming SRCCL. Please revise the language here along the lines of their finding, e.g. SPM C3: "CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (high confidence)."; C3.3 "Carbon cycle and climate system understanding is still limited about the effectiveness of net negative emissions to reduce temperatures after they peak (high confidence)" D.1.2 "Overshoot trajectories result in higher impacts and associated challenges compared to pathways that limit global warming to 1.5°C with no or limited overshoot (high confidence). Reversing warming after an overshoot of 0.2°C or larger during this century would require upscaling and deployment of CDR at rates and volumes that might not be achievable given considerable implementation challenges (medium confidence). {1.3.3, 2.3.4, 2.3.5, 2.5.1, 3.3, 4.3.7, Cross-Chapter Box 8 in Chapter 3, Cross-Chapter Box 11 in Chapter 4}". Given the prominence of the discussion on feasibility and risk of CDR-technologies, and consequences for scenarios-building, we strongly encourage to give some more room here to explain the choice of scenarios and their limitations. [Government of Germany, Germany]	Accepted. RCP1.9 is now included. "not-yet-possible" was now changed to "Achieving the RCP2.6 pathway would require implementation of negative emissions technologies at a not-yet-proven scale to remove greenhouse gases from the air, in addition to other mitigation strategies such as energy from sustainable sources and existing nature-based strategies".
18293	1	42	53	42	55	"identified by their total radiative forcing of greenhouse gases" - This is not correct as it only described net radiative forcing of additional anthropogenic greenhouse gases. [APECS Group Review, Germany]	Accepted. Revised to "by their approximate net additional anthropogenic radiative forcing"
18295	1	42	56	42	56	SR1.5 is not a valid reference. [APECS Group Review, Germany]	Accepted. Corrected
18267	1	42	56	42	57	It is unclear why the radiative GHG forcing of 2.5-3 Wm2 gives a net imbalance of 0.5-1 Wm2. Might be worth clarifying. [APECS Group Review, Germany]	Accepted. This is removed to avoid confusion.
13783	1	42	57	43	4	The SR1.5 also introduces RCP1.9 as a 1.5C pathway. It would be good to briefly mention it here and explain why it has been considered in the SROCC. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. RCP1.9 was included.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23041	1	43	0	45		I find the presentation of the two dimensions of likelihood (outcome of expert judgment using IPCC calibrated language on one side, and likely ranges of results on the other side) confusing. I would suggest to separate these two aspects very clearly both in the text and in the figure. [Valerie Masson-Delmotte, France]	Accepted: the figure has been extensively revised in consultation with many IPCC authors. Example text from SROCC has been added to support the table in this figure.
1405	1	43	1	0	9	There is a grammatical error that makes this paragraph difficult to understand. [Jacinta Clay, United States of America]	Accepted. This sentence was rewritten
18297	1	43	1	43	1	Rogelj et al., 2018, tested a RCP of 1.9 W m-2, not 2.6 W m-2 as stated here. [APECS Group Review, Germany]	Accepted. Rogelj et al. was removed here.
22709	1	43	1	43	5	The message here that the Paris Agreement goal of limiting global warming to well below 2°C would require implementation of not-yet-possible negative emissions technologies such as BECCS, DAC or enhanced weathering to remove greenhouse gases from the air is not consistent with the SR15 findings. Note the difference between 'negative emission technologies' and 'carbon dioxide removal, CDR', the latter of which is a term used in the SR15 and doesn't necessarily include negative emission technologies. See for example SR15 SPM page 19, para C.3.2 which sums up that "Some [1.5°C] pathways avoid BECCS deployment completely through demand-side measures and greater reliance on AFOLU-related CDR measures (medium confidence)." See also the P1 scenario in the Figure SPM.3b of the SR15. Furthermore, that BECCS, DAC or enhanced weathering would be not-yet-possible is also not quite consistent with the SR15 findings, which concluded that CDR measures "differ widely in terms of maturity, potentials, costs, risks, co-benefits and trade-offs" (see SR15 SPM paragraph C.3.1). [Greeenpeace Group Review, Republic of Korea]	Accepted. This sentence was rewritten.
29783	1	43	1	43	5	before "alongside", it seems there is a need for extra info such as "in addition to other mitigation strategies such as energy from sustainable sources, " [Dorte Krause-Jensen, Denmark]	Accepted. changes made.
13785	1	43	2	43	2	Some negative emissions technologies are possible, although not yet at scale. Perhaps good to clarify this. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. changes made.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1911	1	43	2	43	3	'not-yet-possible' is incorrect. Perhaps change to 'not yet implemented on a large scale'. Negative emission technologies are plausible but difficult to be implemented on a large scale, e.g: Minx, J. C. et al. Negative emissions—Part 1: Research landscape and synthesis. Environ. Res. Lett. 13, 063001 (2018). Fuss, S. et al. Negative emissions—Part 2: Costs, potentials and side effects. Environ. Res. Lett. 13, 063002 (2018). [Katarzyna B. Tokarska, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. changes to "....at a not-yet-proven scale to remove greenhouse gases from.....".
32869	1	43	2	43	9	This would be a good place to present findings and cite the US National Academies' 2018 assessment report on Negative Emissions Technologies, led by Stephen Pacala: https://www.nap.edu/catalog/25259/negative-emissions-technologies-and-reliable-sequestration-a-research-agenda. [Government of United States of America, United States of America]	Accepted. changes made.
18269	1	43	5	43	6	I would recommend moving this sentence about RCPs being the scenarios used here and in CMIP5 to the beginning of the subsection, ideally 2nd sentence (P.42, l.50). [APECS Group Review, Germany]	Accepted. Done
18299	1	43	7	43	8	Nakicenovic and Swart, 2000, is not the correct citation for this report. [APECS Group Review, Germany]	Accepted. The reference was corrected
2829	1	43	22	43	28	I suggest to add a Cross-Chapter Box to summarize the methodologies used for studying ocean and cryosphere under climate change. For example, in case of ocean, the advancement of theoretical model, regional/global dynamical downscaling, statistical downscaling, or regional/global reanalysis dataset, as well as the applications. [Baoshu Yin, China]	Rejected: We are unfortunately unable to accommodate a cross chapter box on this topic.
18301	1	43	22	43	38	This section appears to come too late, as all the methodologies it introduces have already been described in earlier paragraphs of this chapter. [APECS Group Review, Germany]	Noted: In earlier drafts we grouped information about methods in this section, but in revising the chapter we felt that it was more informative to discuss methods alongside the concepted that they are applied to. This section provides a roadmap to help people locate methodological information distributed throughout the chapter.
4291	1	43	24	43	29	Does this section apply to IK and LK? Because if only peer-review literature is considered (except when important gaps in peer reviewed literature exist) then the importance of IK and LK in the report is, frankly, nominal. In which case why making such a fuss of it in 36 to 41 (6 pages!) [Manuel Barange, Italy]	Noted: Yes, it includes literature on IK and LK, and there is an increasing amount of peer-reviewed literature on IK and LK. The reason that IK and LK is covered thoroughly in chapter 1 is because the methods of including this knowledge in IPCC assessments is less established than for other sources of knowlegde, and so additional framing is needed compared to already established approaches. CCB4 demonstrates that IK and LK is used in each chapter of SROCC.
8769	1	43	26	0		works' should be 'work' [Nina Hunter, South Africa]	Accepted: we have change "works" to "research".

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
242	1	43	31	43	38	It was not clear if the description of Cross-Chapter Boxes applies only to this first chapter or to the other chapters. If it applies to the other chapters, some of the C-C B's are not well-categorised by this description (established methologoeis/ governance options / utilising IK and LK), e.g. C-C B 5 in Chapter 3. [Katsuro Katsumata, Japan]	Accepted: we have specified that we refer to "cross-chapter boxes in chapter 1"
29609	1	43	40	43	40	Just to note that there are no such things as degrees of certainty--one is certain or not. The proper word here is "Confidence", not "Certainty." IPCC has levels of Confidence and this is fine--they are not levels of "certainty". This comment applies to the section title, and to line 42. There are degrees of uncertainty, so that is fine, if one is not fully and completely certain, then that means there are uncertainties, etc. to be concerned about, and it is just not proper to say then that there is "low certainty" or something similar. Please be careful of this. [Michael MacCracken, United States of America]	Accepted: changes made as suggested.
512	1	43	42	44	20	I think it would be wise to include some concrete examples in this section, because the rest of the special report suffers from lack of understanding of how to use this kind of language in a consistent manner. Section 1.9.3 as it stands right now is just as abstract as the original Guide (Mastrandrea et al.), and therefore very difficult to use. [Cecilie Mauritzen, Norway]	Accepted: specific examples derived from the chapters have been added to figure 1.4
14921	1	43	56	44	10	We appreciate the explanation given here on the different ways to derive likelihood statements in the context of IPCC reports. However it seems that this paragraph would benefit from a more precise language and a clearer distinction, e.g. between statistical hypothesis testing (for significance ln 43-57 to 44-1 and other quantitative measures (such as equating a certain range of a model outcome distribution to correspond to a certain likelihood). Can the latter really be qualified as a probabilistic estimate? It might be clearer to start the sentence along the following lines: "Quantitative expression (likelihood scale) is used when findings are based on large sets of data, e.g. model outcomes or observational data, that allow for quantitative evaluation of their probability." On a side note, I'd personally would find it more clear if the order was reversed, "Likelihood scales (quantitative expressions) are used when" and "Confidence scales (qualitative expressions). [Government of Germany, Germany]	Accepted: We have update the text to "Quantitative expressions (likelihood scale) are used when sufficient data and confidence exists for findings can be assigned a quantitative or probabilistic estimate". We have not change the order of the sections as it is designed to reflect the process of evaluating evidence (e.g. process depicted in figure 1.4).
22793	1	44	4	44	10	Lines 8-10: the text gives an example for the estimate of the "likely" estimates of future changes. Please explicitly refer to the right panel of Figure 1.4, step 3. As far as I understand, the term "likely" is not interpreted in the same manner for climate state and future changes in Fig 1.4, step 3; this distinction should be clear to the reader. Maybe, sentences from 4-6 should also explicitly refer to the left panel of Fig. 1.4, step 3. [Jeremy Rohmer, Finland]	Accepted: reference to the figure has been added to this sentence. The figure has also been extensively revised using extensive consultation with IPCC author teams.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2969	1	44	6	44	10	This statement means that in some places of the report, the term "likely range" refers to a probability larger than 66%, as in the IPCC guidances for uncertainties (Mastrandrea et al 2010), whereas in other places, the term "likely" means a probability of exactly 66%. This could be confusing for the reader. An alternative would be to call this later term the "17th-83rd percentile level" as in Kopp et al 2014 (Earth Future) to avoid any confusion.Kopp, R. E., Horton, R. M., Little, C. M., Mitrovica, J. X., Oppenheimer, M., Rasmussen, D. J., ... & Tebaldi, C. (2014). Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. Earth's Future, 2(8), 383-406. [Goneri Le Cozannet, France]	Noted: Our text and figure 1.4 are designed to clarify these differences which are not clear in existing IPCC guidance notes. We have developed the text and figures with extensive consultation amongst IPCC author teams.
2971	1	44	6	44	10	It is also unsure that using the term "likely" to define the 17th-83rd percentile level is usefull or appropriate as the IPCC guidances for uncertainties explicitely allow for using more precise probabilistic statements where possible (see cases 11.D, 11.E and 11.F in Mastrandrea et al 2010 https://archive.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf). [Goneri Le Cozannet, France]	Noted: This is how the term likely has been used in previous IPCC assessments. Our text here is aimed at clarifying the usage that already exists. It is not clear what the review comment is suggesting.
514	1	44	12	44	20	I think it would be useful if this chapter gave a suggestion for language to be used for the high impact-low probability (= risk) cases Sutton (2018) discusses, because it is not useful for IPCC to simply characterize a situation that carries high risk as “Very unlikely”. [Cecilie Mauritzen, Norway]	Noted: We haven't defined a fixed language to use for high impact-low probability scenarios, but we do adopt the term "physically plausible" in discussing these situations in SROCC.
29785	1	44	14	44	14	Please consider adding reference to "What lies beneath the understanding of climate risk", Breakthrough, National Centre for Climate Restoration. breakthroughonline.org.au [Dorte Krause-Jensen, Denmark]	Accepted: This reference has been added as suggested
26319	1	44	16	44	16	It is unclear what exactly “limited” or “emerging” evidence refers to. Are these up to the discretion of the authors? If so, that should be noted clearly, or if there is a more defined metric, that should be transparent. [Ethan Pierce, United States of America]	Noted: these terms are included on the matrix in Figure 1.4 (step 2)
18271	1	44	17	44	17	It would be helpful to clarify the term “deep uncertainty”, since it is not clear how it relates to the general discussion in this paragraph, or at least bring the reference to Cross-Chapter Box 4 forward to make clear that this box will discuss deep uncertainty further. [APECS Group Review, Germany]	Accepted: we have moved the reference to CCB5 forward to follow immediately after the term "deep uncertainty" is used.
30451	1	44	18	44	20	Nevertheless, comprehensive risk assessment that informs adaptation planning togheter with a comprehensive monitoring strategy would also address such highly uncertain changes that could have catastrophic consequences in low resilience areas (Cross-Chapter Box 4). [Michele Capobianco, Italy]	Noted: the sentence has been revised.
26897	1	45	0	0		I am not sure whethere we need this Fig? these are available in IPCC documents, giving reference should be enough. Footnote 1 & 2 in page also explained this. [Golam Rasul, Nepal]	Noted: As the IPCC confidence language is a fundamental part of the report we feel that the information to understand it should be within the report and not another document.
4293	1	45	0	45		I find this figure EXCELLENT. But how do LK and IK fit in it? Nowhere. And this is critical because if that sort of knowledge does not fit in this figure I am wondering whether you should say that LK and IK are not subject to the same constraints on understanding and uncertainty as Scientific Knowledge? [Manuel Barange, Italy]	Rejected: We are glad that you find the figure useful. IK and LK are forms of evidence and this figure does apply also to their usage in assessments and how the IPCC calibrated language is applied.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
31581	1	45	1	0		Figure 1.4. The Schematic examples of likelihood look simple, but they are not easy to understand, particularly the placements of "reference condition" and the " high impact" labels. You could provide a brief explanation in the caption. Or you may consider providing a single probability distribution curve, and divided it amongst the statistical levels (including intervals). [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: We have added statistical levels to the schematics. We have also added examples text to help link the information with real examples from SROCC.
666	1	45	1	45	1	I cannot understand why the red horizontal bar in the last panel (projected change) indicates high impact. [Mengxi Wu, United States of America]	Accepted: We have revised the figure extensively, including using the burning ember representation to more explicitly link the probability of changes with the concept of risk.
2983	1	45	1	45	1	In the 3rd box of Figure 1,4: I do not understand the scheme on the left: the blue area corresponds to a probability of 33% and not larger than 66%. (?) [Goneri Le Cozannet, France]	Accepted: We have added statistical levels to the schematics to make their relation to the likelihood language clearer.
2985	1	45	1	45	1	In the 3rd box of Figure 1,4: I do not understand the scheme on the right: the term "likely" (meaning: probability of 66%, 17th-83rd percentile levels, or probability larger than 66%?) is used to define the blue area, which is the 17th-83rd percentile levels. The same applies for very unlikely and 10%. For clarity, I would suggest to use the term likely as defined in Mastrandrea et al 2010 and use probabilistic statement such as 17th-83rd percentile levels where applicable. [Goneri Le Cozannet, France]	Noted: The figure is designed to clarify aspects of the IPCC calibrated language usage that are not clearly defined in Mastrandrea, and to incorporate new developments since the 2010 guidance note was published.
3439	1	45	1	45	1	This figure needs a better explanation of why the percent levels for "assessing range" and "assessing change" are so different. [Patrick Orenstein, United States of America]	Accepted: The text and figure are designed to clarify how the likelihood language applies to different usages (e.g. assessing change versus assessing range). The figure has been clarified following exstensive consultation amongst IPCC authors.
16479	1	45	1	45	1	Is this adapted certainty definition/language valid for the entire AR6? It unconveniently confusing if this is repeatedly changed. [Georg Kaser, Austria]	Noted: the usage is not being changed, but we are aiming to provide clarity on the different ways it is applied. Our extensive consultation on improving this figure has included AR6 authors.
22795	1	45	1	45	1	Figure 1.4, step 3, right panel carries a lot of information; term "likely", "high imapct", "very unlikely"; the text on page 44 supports the interpretation of "likely", but there seems to be a need for a few words regarding "high impact",with respect to the probability distribution. [Jeremy Rohmer, Finland]	Accepted: The figure has been revised to be clearer, and examples of usage in SROCC have been added.
18303	1	45	1	45	4	The scheme in Step 3 "Schematic examples of likelihood language application" appears to be wrong (or at least difficult to understand with the little information given in the caption). The "likely >66 %" part in the left panel does not correspond to the literature cited here and would at least need better explanation. Also the "high impact" marked in the right panel is at least ambiguous, now depicting that it would have a high probablility (high value on y-axis). [APECS Group Review, Germany]	Accepted: The figure has been revised to be clearer, including a clearer linkage with the burning embers for risk and adding examples of usage in SROCC have been added. The revisions have been done with extensive consulation with IPCC authors.
26289	1	45	1	45	9	Cross-Chapter Box 4, Line 9 mentions Confidence and Deep Uncertainty. It would be useful to indicate the context of both in Figure 1.4. [Zelina Ibrahim, Malaysia]	Accepted: A box on deep uncertainty has been added to the figure.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25573	1	45	9	0		The framing of key questions of this report in the context of “deep uncertainty” outlined here is very unhelpful in my view. First and foremost, other concepts like the “precautionary principle” or “risk framing” exist that can be adopted. Secondly, the box fails to provide any constructive solutions on how to deal with such uncertainties. Simply not providing any information on uncertain areas (including key findings expected from this report such as tipping risks of ice sheets) is not an acceptable outcome and does also not reflect the scientific literature. Furthermore, the concept is deployed in such a way that it holds other key issues hostage. For example, the SPM does not provide any information on long term SLR due to uncertainties in the response of the Antarctic ice sheet. Another and much more promising option would be to provide separate estimates for Antarctica and all other components. [Schleussner Carl-Friedrich, Germany]	Taken into account - the text has been revised and examples have been elaborated to clarify the intended purpose of the CCB-5. As a concept that is now appearing in the climate change litearure, including that assessed in SROCC, we are expected to make reference to it and address it in the context of climate-related changes in the ocean and cryosphere.
21783	1	45	9	48	43	Box 4 is heavily focused on how uncertainty can be reduced by researchers - but little on the other side of the coin on how decision makers can work with various levels of uncertainty. Given this is a framing Chapter - the Box should be expanded to also highlight how adaptation can be accomplished despite varying levels of uncertainty to make it more relevant to stakeholders (rather than giving impression its up to researchers to dela with uncertainty. This joined up connection with adaptation/policy responses and levels of uncertainty are in for example Refs: Walker, W, Lempert, RJ, Kwakkel, JH (2013) Deep uncertainty. In: SI Gass & MC Fu (Eds). Encyclopedia of operations research and management science. Springer US, New York: 395-402 and Walker, WE, Haasnoot, M, Kwakkel, JH (2013). Adapt or perish: A review of planning approaches for adaptation under deep uncertainty. Sustainability 5: 955-979. There is only tacit reference to this aspect in lines 48-50 on page 47 - which doesn't address the Level 3 situation where there is disagreement among decision-makers /communities/ stakeholders on outcomes , or contested views/ideas. [Robert Bell, New Zealand]	Taken into account - references are relevant and text revised to consider mentioning them.
5253	1	45	9	48	58	Cross Chapter Box 4: Confidence and Deep Uncertainty - Would be extracted, eliminating for example, the teoretical explanation that maybe seek in the literature realized by IPCC. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Taken into account - the intention of the Box was to introudce the concept with refeenes to SROCC material. We have revised the text to be less encyclopedic.
4295	1	45	9	50	21	The Box on deep unceratinty is, in my view, Excellent. [Manuel Barange, Italy]	Noted.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14923	1	45	9	50	21	CC Box 4: This box is very useful in explaining and understanding the concept and challenges of deep uncertainty. It is well developed and written and care should be taken that terminology and conclusions across the SROCC are consistent with the content of CC Box 4. Please add some more detail to the explanations of Case B - it is not clear to the reader from the explanation how the uncertainty can be "not deep" before 2100 but still deep beyond 2100. Is the message here really "we are safe until 2100, but no one knows what will happen after"? If yes, it should be better explained. Else the formulation should be adapted to convey less certainty for the period up until 2100. Also, for the assessment of the likelihood of catastrophic sea level rise, the year 2100 seems like an artificial boundary. As we have stressed elsewhere, post-2100 SL commitment is a vital issue that should always be communicated as well. [Government of Germany, Germany]	Taken into account - the box text, and Case B, have been revised considering this advice.
25303	1	45	9	50	21	The examples provided in this cross chapter box are very helpful to narrow down on the different types and sources of uncertainty, as well as bring clarity to the uncertainty language by providing concrete instances. [Sarah Cooley, United States of America]	Noted.
32871	1	45	9	50	21	The title and premise behind this cross-chapter box on "deep uncertainty" are misleading and the box requires major revision. The three cases of "deep uncertainlty" are no deeper than case studies that could be reported for a number of species interactions and societal responses or outcomes. Authors do not need to coin a new phrase on "deep uncertainty" that will confuse policymakers and invite others to discredit the science. Refer to the three case studies as they really are: "major scientific challenges". Why aren't "surprises" mentioned here? There *will* be surprises. The U.S. Fourth National Climate Assessment Volume I (Climate Science Special Report) devotes a whole chapter to the topic. [Government of United States of America, United States of America]	Taken into consideration - The terms appears in the published literature, hence our task here to assess the literature that mentions the concept in the context of changes in the ocean and cryosphere. The text has been revised since the Second Order Draft to better exemplify the way in which the term is used and applies in cases depicted in SROCC.
668	1	46	2	46	6	The three types of deep uncertainty are not so easily understood. Perhaps it is better to further explain these concepts before applying them to following cases. [Mengxi Wu, United States of America]	Taken into consideration - the introductory text has been revised and references to the definition also complemented with an entry in the SROCC Glossary
8771	1	46	5	0		Comma and semi-colon should be swopped [Nina Hunter, South Africa]	Accepted. Text revised accordingly.
26291	1	46	8	46	12	Some additional literature on deep uncertainty would be useful. The papers by W.E. Walker (Delft University of Technology) and others are relevant. [Zelina Ibrahim, Malaysia]	Taken into account - additional and relevant references, as suggested, have been incorporated in the revised text.
8773	1	46	10	0		Should it not be 'Knightian uncertainty' instead of 'Knightian' uncertainty? [Nina Hunter, South Africa]	Accepted - yes, it should be 'knightian', text revised accordingly.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5605	1	46	12	46	12	A widely used uncertainty typology in adaptation assessments is that of Walker 2003 and 2013. There is a book currently in press and due out shortly that is a compendium of theory and practice of deep uncertainty. It would enhance this report to quote it since the report will be a contemprary source of published knowledge on such issues. Reference is Marchau, V.A.W.J., W.E. Walker, P.J.T.M. Bloemen, and S.W. Popper (eds.) Decisionmaking under Deep Uncertainty – From Theory to Practice. Springer, New York, NY, USA. [Judy Lawrence, New Zealand]	Accepted - reference came to our attention as we were finalising the final draft, reference has been added.
8775	1	46	24	0		Remove comma after 'it' so that the text reads in a flowing manner [Nina Hunter, South Africa]	Suggested revision has been made
3403	1	46	30	46	31	What does "expert judgement" mean? Give examples of other times in which this has been used reliably. [Patrick Orenstein, United States of America]	We have added a reference to AR5 discussion of the application of expert judgment to climate sensitivty that goes into greater detail about this term, which is common in IPCC reports.
29787	1	46	34	46	39	I do not understand this sentence well. Please briefly define " Equilibrium climate sensitivity" also here in the summary for the reader to understand.. [Dorte Krause-Jensen, Denmark]	We have added a reference to a very detailed AR5 discussion of equilibrium climate sensitivity. This box does not have enough space for this to be placed here.
18305	1	46	35	46	39	The chapter by Church et al., 2013, that is referred to here, deals with sea level rise and not with climate sensitivity. As is done for later citations, a page number would be useful. [APECS Group Review, Germany]	The citation has been corrected and page number added
8777	1	46	40	0		Remove comma after 'essentially' as it is unnecessary [Nina Hunter, South Africa]	We disagree and has left the comma for the copy editors to decide.
18273	1	46	42	46	42	Has deep uncertainty really been “eliminated” regarding this problem. I’d suggest rephrasing as “progressively reducing” or similar. [APECS Group Review, Germany]	We take the reviewers point and have added wording that is specific about which aspect of climate sensitivty is no longer characterized by deep uncertainty.
16699	1	46	44	46	44	I think 'dynamical ice loss" should be quickly introduced/defined here, or it will be quite difficile for non-expert reader to understand (maybe at least a link to the relevant Chapter 3 section could help ?) [Samuel Morin, France]	The text has been moved. The appropriate section in chapter 4 is now cited for an explanation of dynamical ice loss.
8779	1	46	51	0		as' should be 'in' [Nina Hunter, South Africa]	This section of text has been deleted.
8781	1	46	52	0		sheets' not 'sheet' [Nina Hunter, South Africa]	This section of text has been deleted.
23043	1	47	0	47		for permafrost please refer to representation of processes in models, model fit for purpose, and check coherency with SR15 (SR15 reported a possible range of CO2 emissions from thawing permafrost for 1.5°C carbon budgets, see chapter 2). For larger amounts of warming, deep uncertainty emerges. Could the box also report how the concept is used in the other chapters? It is missing. Issues like "black swans", "tipping points" may also be relevant. [Valerie Masson-Delmotte, France]	Noted-these seem to be addressed by the revisions
16701	1	47	3	47	3	The text uses "judgment" and "judgement". This should be checked thoughout and homogenized. [Samuel Morin, France]	Accepted - term used should be judgement. Text revised and updated accordingly.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
26899	1	47	5	47	21	case A: I am not sure whatever presented in this para is present deep uncertainity or knowledge gaps? ethere we need this Fig? these are available in IPCC documents, giving reference should be enough. Footnote 1 & 2 in page also explained this. [Golam Rasul, Nepal]	Noted-the examples for permafrost follow the definitions as written in the outset of the box. (1) appropriate conceptual models that describe relationships among key driving forces in a system; (2) the probability distributions used to represent uncertainty about key variables and parameters; and/or (3) the weigh and and value given to desirable outcomes.
14925	1	47	6	47	10	Please improve the referencing to clarify the AR5 in this case stands for the WGI contribution to AR5, in particular for the reference to Figure 6.20. [Government of Germany, Germany]	Accepted - reference revised and updated.
18307	1	47	6	47	8	It could be mentioned here or later in this paragraph that by now uncertainty estimates are available for the size of the organic carbon pool stored in permafrost, see Hugelius et al. Estimated stocks of circumpolar permafrost carbon with quantified uncertainty ranges and identified data gaps. Biogeosciences 11, 6573–6593 (2014). [APECS Group Review, Germany]	Taken into consideration. This was in there specifically, but now is grouped more generally under the last sentence saying that SROCC has addressed a number of these issues.
21589	1	47	7	47	7	"soils in the peramfrost region" zones are the subsets of the permafrost region [Stephan Gruber, Canada]	Accepted. This was a typo and now is corrected.
21591	1	47	23	47	23	What is "temperate permafrost" ? [Stephan Gruber, Canada]	Accepted. This was a typo and now is corrected.
25965	1	47	23	47	23	is 'temperature' permafrost a correct term? [Regine Hock, United States of America]	Accepted. This was a typo and now is corrected.
1931	1	47	23	47	24	you may put instead "cold-temperate permafrost" or "boreal permafrost" [Harald Pauli, Austria]	Accepted. This was a typo and now is corrected.
18275	1	47	27	47	28	The previous paragraph states that studies since AR5 resulted in a widening of the uncertainty range. This sentence says that SROCC has “reduced uncertainty”. This gave me pause, since SROCC is based on studies since AR5. Can this be clarified? [APECS Group Review, Germany]	Accepted. Text was revised in the last sentence to reconcile these seemingly opposing statements.
8783	1	47	30	0		Insert 'which was' before 'not' [Nina Hunter, South Africa]	Sentence has been edited to remove this problem.
24935	1	47	30	47	31	Modelling of marine ice sheet instability was possible for AR5. Some models did, not all. This should be rephrased. [Frank Pattyn, Belgium]	Sentence has been edited to remove this problem.
30547	1	47	30	47	35	Please refer to cross chapter box 6 in chp 3 [Hans-Otto Poertner and WGII TSU, Germany]	Citation to CCB6, chapter 3 added
21785	1	47	30	47	50	For this Framing Chapter - it would be helpful to address a common misconceptions relating to uncertainty and SLR projections in this Case B - that is the attempt by practitioners and decision-makers to assign probabilities to SLR projections for any RCP - or use a "best estimate" or "most likely" estimate. And also would be useful to outline the difference between probabilistic projections (expressed as percentiles) for a given RCP (e.g. Kopp et al 2014, 2017) and the probability of occurrences (overall PDF) for SLR values. Addressing this aspect would help with how decision-makers handle information on SLR projections in the context of the uncertainties. [Robert Bell, New Zealand]	The reviewer makes an interesting point. We now cover this point (deep uncertainty arising from emissions scenario uncertainty), albeit briefly, in the subsequent paragraph.
18309	1	47	43	47	47	The citation Bamber et al., 2018, could not be found. Instead the original Bamber & Aspinall, 2013, that de Vries and van de Wal, 2015, are commenting on should be cited here. [APECS Group Review, Germany]	Bamber et al 2019 has now been accepted so the reference has been completed.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
26901	1	47	53	47	55	not sure- whether compound risks are an example of deep uncertainity [Golam Rasul, Nepal]	Since the statistical likelihoods of such a sequence of events occurring is unknown, compound risks are an example of deep uncertainty
1525	1	48	8	0	17	I believe these sentences would benefit from citations. [Jacinta Clay, United States of America]	In the interests of shortening the length of the box overall, the mentioned sentences have been removed and a reference to box 6.1 (which contains the various references) has been provided instead
30559	1	48	8	48	22	This case study has limited links to ocean and cryosphere, with the marine heatwave not well integrated [Hans-Otto Poertner and WGII TSU, Germany]	The El Nino/La Nina conditions that contributed to the extreme weather conditions and the ensuing fires and floods as well as the marine heat wave are all linked to ocean dynamics and so are extremely relevant to the topic of this report. Much of this context is provided in the full case study in chapter 6
1527	1	48	25	0	36	I find something about the phrasing difficult to read. "...coupled with...are key sources" strikes me as especially difficult to follow. [Jacinta Clay, United States of America]	Taken into account - text revised to simplify and clarify the sentence.
18277	1	48	39	48	40	I would encourage a reordering of this list, since in my opinion “invoking multiple lines of evidence” and “scenario-building” should carry more weight in reducing uncertainty, compared to expert elicitation and judgement. [APECS Group Review, Germany]	Taken into account - however the relevance for each of these approaches would depend strongly on the context, in each case the mix and priority of approaches would be different and contingent on those who engage in that application. Our text is intended to be a conceptual presentation of the term rathert han a prescription of which approach to prioritise.
5607	1	48	40	48	43	The following statements show a level of optimism that is unlikely to be achieved as described. "These approaches can feasibly reduce or eliminate deep uncertainty in complex situations, keeping in mind the importance of depicting sources for disagreement that can lead to situations of deep uncertainty (Adler and Hirsch Hadorn, 2014). However, obstacles should not be underestimated and reducing deep uncertainty can take decades." Methods described in the Marchau et al book in press shows many examples of how deep uncertainty can be addressed but not eliminated. The text should not be giving the impression that that deep uncertainty can be eliminated and there is no evidence presented here to support the last sentence. How do we know reducing deep uncertainty can take decades. It seems tautological to suggest as much. REF Marchau, V.A.W.J., W.E. Walker, P.J.T.M. Bloemen, and S.W. Popper (eds.) Decisionmaking under Deep Uncertainty – From Theory to Practice. Springer, New York, NY, USA. The processes described line 38-40 can reach consensus at best but the uncertainty still remains. It is the decision process that is better informed by stress testing response options against several or many plausible futures (derived from expert elicitation). The reference cited is the most up todate compendium of knowledge on this issue and should be available before completion of this report. Proofs are being checked currently. [Judy Lawrence, New Zealand]	Taken into account - text revised and reference integrated.
16703	1	48	55	48	55	Reference to Bamber et al. incomplete. [Samuel Morin, France]	Accepted: Bamber et al 2019 now has been accepted for publication. Reference is now complete.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23045	1	50	0	50		The storyline may be introduced at the very beginning rather than here. It can finish by a sort of disclaimer on what is not assessed (eg , to check : lake and river ice; methane clathrates…?). [Valerie Masson-Delmotte, France]	Noted: We discussed this, but prefer to keep the storyline as the lead in to the following chapters. We have included additional examples of what isn't assessed.
8785	1	50	33	0		Remove 'in' before 'elsewhere' [Nina Hunter, South Africa]	Accepted: correction made
24337	1	50	33	50	33	Replace "covered in elsewhere" with "covered elsewhere" [Philippus Wester, Netherlands]	Accepted: correction made
1933	1	50	35	50	36	"(e.g. cold-temperate permafrost and low altitude snow cover and permafrost)" [Harald Pauli, Austria]	Noted: the text has been revised slightly.
16705	1	50	41	50	43	The definition of High Mountains here is quite short and not exactly consistent with the Chapter 2 definition. It may be useful here to refer to the WMO definition : High mountains are "mountain areas where seasonal or perennial cryosphere is present and poses a potential and serious risk to society related to water scarcity and disaster resilience" as resolved by the 69th Executive Council of the World Meteorological Organisation (WMO) in 2017. [Samuel Morin, France]	Noted: The text has been revised slightly but doesn't not follow the wording of the WMO definition exactly. It does contain all of the information that is within the WMO definition.
17317	1	50	45	50	45	Include "..., especially Indigenous Peoples," after "people" in this line [Joanna MacDonald, Canada]	Rejected: we have not implemented this suggestion as the statement already applies to all people. Additionally, the Arctic isn't the only region where SROCC specifically assesses the effect of ocean and cryosphere change on Indigenous Peoples.
8787	1	50	47	0		Should 'including' not be 'includes'? [Nina Hunter, South Africa]	Noted: sentence has been revised.
23047	1	51	0	51		FAQ1Several elements are vague and need precision. Ex : "very unusual" => compared to what? "path towards conditions not experienced in million years" : incorrect if you look at regional information (eg lack of glaciers in mid Holocene in some regions; polar warming of the last interglacial for Arctic and Antarctic). Check very very carefully. Explain what "rapid" is at the end. [Valerie Masson-Delmotte, France]	Noted: Comment taken into account by revising the text throughly and noting that we refer to the global-scale changes.
14927	1	51	3	52	19	As said in our comment to p5-8 ff, It is not clear why the authors chose 100 km distance from the shore and 100 m elevation as qualification - is this a standard definition for "coastal zone"? The reference to less than 10 m elevation above SL given in the introduction on p5-8 ff seems intuitive as a threshold for vulnerability to extremely high sea level events, erosion and other climate change impacts, but is not included here. Please also try to specify other numbers for potentially affected people in this section. For example, ESL threatening millions of lives (ln 53ff) could be an understatement or an exaggeration depending on the quality of the threat (mortal danger or risk of severe impacts, loss of livelihoods, …) and the scenario. Please revise. [Government of Germany, Germany]	Noted: we changed the text to refer to the 10 m elevation as provided in the main text. The distance and elevaton benchmarks are consistent across the full SROCC and rationales are explained in the Chapter text. It is appropriat for a general audience FAQ to present the benchmarks , for an FAQ the rationales for therm are considered technical details inappropriate for an FAQ for a general audience.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17319	1	51	3	52	19	Somewhere in the first three paragraphs of this first FAQ there should be explicit mention of the effect of ocean and cryosphere changes on Indigenous Peoples. This content can be taken from earlier on in this chapter where it is discussed and doesn't require extensive addition. The main concern is that the higher burden of climate-related impacts it felt by Indigenous Peoples whose health, livelihoods, and cultures depend on the land, water, and sea ice. This point should not go without mention in the FAQ. [Joanna MacDonald, Canada]	Rejected: While we fully agree that indigenous peoples and cultures are particularly vulnerable, we do not want to call out a particular group in this FAQ. By mentioning a particular group and not all, one automatically excludes other groups. For example, we would consider the inhabitants of deltaic systems such as those living in Bangladesh also as particularly vulnerable to climate change and sea level rise.
16789	1	51	3	52	21	FAQ1.1 gives a good introduction into the role of Cryosphere and Ocean for (human) life. Some minor comments: the para starting ln 9 comes very abruptly, it would be useful to start with a more general line on humanity being tied directly and indirectly to Ocean and Cryosphere. Also, the reference to coastal areas is not really put into perspective and could probably be omitted (as closeness to Ocean is not necessarily an indicator of dependence on Ocean and Cryosphere). The concluding paragraph should be formulated in a less prescriptive way, instead of "urgent action are essential", maybe say sth like: "changes in/the fate of… depends on near term mitigation", describing the relationsship rather than the action required. It would be helpful to add a little more detail on the issue of "committed change" and add that despite that, lower warming levels still lead to less risky outcomes. We are looking forward to the fully developed infographic in the next version. [Government of Germany, Germany]	Noted: The FAQ was thoroughly revised and shortened, taking some of the comments into account. Also the last paragraph was reformulated to be less policy prescriptive.
18279	1	51	11	51	12	I wonder whether this statement is too strong, maybe “evidence suggests” would be more defensible, rather than “evidence shows”? Also, it should be clarified that this statement only refers to changes on timescales longer than the seasonal cycle (there’s large seasonal changes in the sea ice cover each year, for example, which are not mostly due to human influence). [APECS Group Review, Germany]	Noted: The FAQ was thoroughly revised. This particular statement is no longer in the FAQ.
24339	1	51	13	51	13	replace "had" with "have" at end of sentence [Philippus Wester, Netherlands]	No longer necessary to address. With the shortening of text the sentence no longer exists.
9489	1	51	16	51	18	We suggest to add culture among the links between people and the ocean. [Government of France, France]	Accepted: culture was added
11629	1	51	16	51	19	[…] and livelihoods of millions more are tied closely to the ocean through trade, food, transportation, [communication], and recreation. In relation with the communication, the most part of internet communication is through submarine cables, this represent a support services. [Government of Mexico, Mexico]	Rejected: adding communication without further explanation would be confusing. In addition, although certainly relevant for human societies, it is a very indirect service.
25305	1	51	18	51	18	Make consistent with figure for non-grain protein provided earlier in chapter [Sarah Cooley, United States of America]	Accepted: Figure changed to 17% as given in main text
29905	1	51	19	51	19	UNCTAD suggests 80%, but ICS suggests 90%, so perhaps give a range here? [Anna Zivian, United States of America]	Accepted: changed to "at least 80%"

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24649	1	51	23	51	37	This paragraph doesn't really directly address the question 'why is this relevant to people who live far from the ocean'. Need to include a greater focus an explanation that the ocean helps govern and regulate local and regional weather and environment everywhere on Earth. curently this paragraph is a bit weak in the explanation. [Shutler Jamie, United Kingdom (of Great Britain and Northern Ireland)]	Noted: First sentence starts now with "every one of us"
8789	1	51	24	0		Consider changing 'is taking' to 'takes' [Nina Hunter, South Africa]	No longer a potnetial problem: Due to major changes in the text, this statement no longer exists
670	1	51	25	51	27	The ocean is "one of" the conduits to transport heat around the globe, because the contribution from atmosphere is not neglectable, especially in the mid- to high-latitudes. [Mengxi Wu, United States of America]	No longer a consideration: Due to major changes in the text, this statement no longer exists
4345	1	51	25	51	27	The poleward heat transport is much larger in the atmosphere than in the ocean; at least north and south of 30° [The UBern Team Group Review, Switzerland]	No longer a concern: Due to major changes in the text, this statement no longer exists
16791	1	51	26	54	6	FAQ1.2 requires some work, both conceptually and on detail. Figure 1 is very useful, it may help to structure the whole box along the relationsship introduced there. In our understanding, FAQs are meant to convey and clarify concepts and relationsships underlying the assessment, in more accessible language than the main chapters. However, they should not summarize key findings of the report and must be carefully drafted to avoid prescriptive language. FAQ1.2 walks a fine line here, and we'd recommend for the authors to put some more emphasis on general relationsships, and change the title and the tone of the Box from "How will changes ...affect MEETING the SDGs" to "How do changes in ... interact with/influence the (different dimensions of Sustainable development captured in the) UN SDGs". Given that a short box will not be able to provide an assessment of the change to the ways or probabilities of meeting those goals, it would be more clear to summarize key relationsships and point to key risks. Also, please be very diligent with the use of language describing the scope and mandate of the UN SDGs. [Government of Germany, Germany]	FAQ 1.2 has been extensively edited, and the figure revised substantially. Now it does not foreshadow what findings will emerge from individual chapters, but does continue to present direct linkages between changes to features of the ocean and cryoshpere and likely impacts on progress towards achievement of indivudal SDGs. It also has the reciprocal relationships of how efforts to achieve several of the SDGs could lower risks of detrimental impacts on human well-being due to oceanic or cryospheric changes dirven by climate change. However, care is taken to ensure no prescriptive text relative to policy choices is presented when these SDG to ocean-and-cryosphere linkages are discussed
25967	1	51	28	51	28	this statement gives a wrong impressiong. Thermal expansion is a considerably smaller component to current sea level rise than the mass input by ice melt [Regine Hock, United States of America]	Accepted: although we do not provide any quantitative statement, we changed the sequence
16787	1	51	29	0		Please substitute the word "buoyant" by a term that is more easily understood by non-experts [Government of Germany, Germany]	Accepted: Statement was reformulated
28339	1	51	29	51	29	Buoyant. What do you mean? I don't understand why this is THE argument that explains why the transport of oxygen from the surface is reduced? [Anne GUILLAUME, France]	Accepted: Statement was reformulated
18311	1	51	29	51	30	Warmer ocean surface waters do no only impede O2 transport to deeper waters but also decrease O2 solubility for those surface waters. [APECS Group Review, Germany]	Accepted: Statement was reformulated
18313	1	51	29	51	31	"needed for breathing" - rather to sustain organisms living there? [APECS Group Review, Germany]	Accepted: Statement was reformulated

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
8791	1	51	31	0		Consider changing 'has also taken' to 'takes' [Nina Hunter, South Africa]	Rejected: Due to major changes in the text, this statement no longer exists
11823	1	51	34	51	35	Most important is phytoplankton and dinoflagellates not being able to form their shells since they are base of food chain. [William Lorenz, Australia]	Accepted: in response to comment 18315, we added a list of the groups that are most strongly affected
18315	1	51	34	51	35	The sentence should be structed differently to include all calcifying organisms: "...marine organisms that build their shells and structures out of mineral carbonates, such as corals and mussels." [APECS Group Review, Germany]	Accepted: the groups are now mentioned explicitly
29907	1	51	35	51	37	discuss interactions among these stressors as well? [Anna Zivian, United States of America]	Rejected: While certainly relevant, the tight space requirement precluded us to open yet a new set of issues.
18317	1	51	36	51	36	As explained before, deoxygenation is caused by warming and not an uncoupled additional stressor. [APECS Group Review, Germany]	Noted: Ocean deoxygenation is caused by warming AND stratification/circulation changes. This is now made more clear.
8793	1	51	39	0		Consider removing comma after 'changes' to make it read better [Nina Hunter, South Africa]	Rejected: Due to major shortening and revision of the text, this statement no longer exists
24341	1	51	39	51	39	delete comma after changes [Philippus Wester, Netherlands]	Rejected: Due to major shortening and revision of the text, this statement no longer exists
18319	1	51	43	51	43	It would help to add a brief explanation why excess nutrients are negative for marine ecosystems, e.g. "(excess nutrients leading to excessive growth and subsequent oxygen depletion)". [APECS Group Review, Germany]	Rejected: Due to major shortening and revision of the text, this statement no longer exists
18321	1	51	43	51	43	For the general term "pollution" examples could be given (plastic, heavy metals, POPs,...?). [APECS Group Review, Germany]	Accepted: list was added
18323	1	51	45	51	45	"resulting in loss of organisms" - Does this mean net loss of species or shrinking populations? [APECS Group Review, Germany]	Rejected: Due to major shortening and revision of the text, this statement no longer exists
25969	1	51	49	51	50	replace ocean with sea ice [Regine Hock, United States of America]	Accepted: reformulated
25971	1	51	49	51	50	better to sort list more logically (glaciers and ice sheets are similar) [Regine Hock, United States of America]	Accepted: reformulated to "where ice is in direct contact with the sea-water"
18281	1	51	49	51	56	This paragraph reads a little sensationalist. I understand that FAQs don't include references, however, speculations that parts of the Antarctic ice sheet may drain within a few hundred years and cause rapid sea level rise are based on hotly contested research in the field. Additionally, parts of the Antarctic ice sheet have been gaining mass, and it is not even fully established whether Antarctica is net gaining or losing ice, so the second sentence in this paragraph may be seen as potentially misleading. [APECS Group Review, Germany]	Noted: reformulated
25973	1	51	51	51	52	not the base of the ice sheet which according to 1.1 does not include the ice shelves. Better: "is the melting of ice that is in direct contact with seawater" [Regine Hock, United States of America]	Accepted: shortened to "where ice is in direct contact with the sea-water"
21593	1	51	55	51	55	Delete "(areas of ground which remain frozen over years)" you have given a definition earlier and also, this one here is not the correct one. [Stephan Gruber, Canada]	Accepted: definition was deleted
18325	1	51	55	52	2	Thawing of permafrost is not only releasing methane but also (and likely chiefly) CO2. [APECS Group Review, Germany]	Accepted: added "CO2"

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27507	1	51	56	51	56	Not just infrastructure but actual land - for example the a landslide, almost certainly related to thawing ground that triggered a tsunami that killed four people and led to the evacuation of a whole village in Greenland in 2017 [Ruth Mottram, Denmark]	Accepted: added "destabilizing soils"
15227	1	52	0	0		SDG related findings are very important and should be elevated to the ES if possible, i.e. discussed in more detail apart from a FAQ! [Government of Gambia, Gambia]	Noted: SDG elevated to ES
23049	1	52	0	52		FAQ1 and figure I suggest to expand on the notion of irreversible changes : which aspect, which time scale. This is very important. It is not restricted to centuries and goes to millennia. Note : "climate warming" does not make sense. I suggest : with the level of warming at the Earth"s surface. [Valerie Masson-Delmotte, France]	Noted: Climate warming was replaced with "Warming of the climate system". A statement about timescales was added.
32613	1	52	0	52		the text here is too small, which makes the figure pretty uncompelling bc the impacts disappear with respect to the much larger, full color graphical content [Kim Cobb, United States of America]	Noted: The figure has been completely revised
25401	1	52	0	53		all this focus on SDGs in this FAQ maps across individual SDGs but does not emphasise a) how OCC will affect ability to achieve all SDGs (Ie if OCC is not addressed everything else is compromised) and b) how the SDGs can help tackle ICC (eg in emphasising need for holistic approach, importance of social inequality, systems thinking etc) [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	Noted - figure has been rewoked on.
23051	1	52	0	54		There is a major inconsistency, because SDGs are 2030 targets, and we are talking about longer term changes in ocean and cryosphere. A broader approach is needed (sustainability, and then using SDGs as tools to expore dimensions of sutainability). Economic aspects (tourism, jobs) to be covered too. I strongly disagree with the statement on "more powerful tropical storms" given the confidence associated with this from chapter 6 and the lack of clear signals in observations oustide one specific Atlantic region. A focus on marine heat waves would be more grounded in solid science. I am also uncomforable with a way of writing that does not convey the notion that the ocean and cryosphere are key components OF the climate system. Finally, this is the FAQ where to place the link between the caose of climate change (burning fossil fuels) and plastic pollution (making plastics from petrochemistry as a complementary use of fossil fuels). It is very very relevant! [Valerie Masson-Delmotte, France]	Rejected- outside teh scope for the FAQ due to space issue
8795	1	52	1	0		Consider changing 'for releasing' to 'to release' [Nina Hunter, South Africa]	Noted :text revised
56	1	52	1	52	1	This figure should not be duplicated in a form so similar to fig. 1.1. Fig. 1.1. which is a nice one, should just be the only figure, so space can be saved. [Baylor Fox-Kemper, United States of America]	Noted: This was a placeholder. The final figure is now very different.
3441	1	52	1	52	1	The depicition of exhaust from a ship and a plan raise questions about the magnitude of those two carbon sources which are beyond the scope of the SROCC. [Patrick Orenstein, United States of America]	Noted: This was a placeholder. The final figure is now very different.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16707	1	52	4	52	8	The snow cover also plays a key role in reflecting radiation. This should be made more explicit - on glaciers and sea ice, it is often snow which reflects the radiation, this is not captured either. "Loss of ice" could be replaced by "loss of ice and snow cover reduction". [Samuel Morin, France]	Noted: Snow is now explicitly included in the statement.
11727	1	52	10	52	11	The following statement needs a qualifier as to timinglag. "By reducing greenhouse gas emissions, risks can be reduced or even avoided, and the effectiveness of adaptation efforts improved" IN a FAQ it is important that the inertia in the oceans with respect to SLR is properly acknowledged. There is already built in SLR from past emissions and this also needs to be acknowledged. FAQs are likely the most accesible part of this report after the SPM so much care is needed to cover all the important messages. The one raised here is key. [Judy Lawrence, New Zealand]	Noted: inertia is now emphasized more.
18327	1	52	10	52	14	In this paragraph it should also be stated that some responses to climate change are lagging behind, i.e. will peak after CO2 concentrations have peaked. [APECS Group Review, Germany]	Noted: inertia is now emphasized more.
29611	1	52	10	52	14	Suggesting that sea level rise is likely to continue for only "several centuries" seems a really serious understatement with respect to the consequences of the changes started with ice sheets--their effects could well continue for many millennia. If, as paleoclimatic evidence suggests, the equilibrium sea level sensitivity is of order 15-20 m per degree C, then even with the 1 C warming at present, there is a lot of rise to go before equilibrium. It seems to me essential to be very forthright with policymakers, etc. on these points--and in that regards, the presentation of this information is far too hidden and not sufficiently made clear in the SPM [Michael MacCracken, United States of America]	Accepted: We now write "centuries to millennia"
25975	1	52	14	52	14	essential for what? [Regine Hock, United States of America]	Noted: Statement was reformulated
1935	1	52	15	52	16	FAQ 1.1, Figure 1: I suggest some few changes in the illustration: (1) the river looks like flowing down and uphill; (2) permafrost usually does not sit in the middle of a mountain slope, but from high elevations downhill; (3) mountain-top glaciers are common in the tropics and some arctic areas, but valley glaciers starting from just below the high peaks are the more common cases. [Harald Pauli, Austria]	Noted: This was a placeholder. The final figure is now very different.
11805	1	52	15	52	17	The table should also address the loss of biodiversity in the ocean and the overexploitation of fisheries. [William Lorenz, Australia]	Rejected: There is no table in FAQ1.1
25307	1	52	15	52	18	Suggest instead of pH in final figure, say "acidity" with an up arrow. It's more parallel to the other concepts in the figure (Ocean Heat Content, Sea Level, Oxygen) that way. [Sarah Cooley, United States of America]	Noted: This was a placeholder. The final figure is now very different.
16481	1	52	16	52	16	The Arctic is basically missing in this cartoon [Georg Kaser, Austria]	Noted: This was a placeholder. The final figure is now very different.
18259	1	52	18	53	18	FAQ 1.2. The phrase "(SDG 15 - Life on Land)" should be placed directly after reindeer. Caribou could also be added here. [APECS Group Review, Germany]	Accepted - text revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28453	1	52	24	54	6	There is not mention of the crucial issues of SDG implications in the ES. Please enable the SPM authors to draw SDG related content from the chapter! [Government of Saint Lucia, Saint Lucia]	Accepted: SDG information is now available in the section - why this report?
18261	1	52	26	0		FAQ 1.2. No mention is made of the fact that pursuit of SDG 8 - "Decent Work and Economic Growth" - may actually exacerbate climate change. Perpetually growing economies may in fact be unsustainable even if the word "sustainable" is added in front of "development." [APECS Group Review, Germany]	Accepted: Have added explicit reference to the general reciprovity issue. We choose an illustration tha tis uniqe to the ocean and cryosphere scope of SROCC, and leave for AR^ to challenge the large issue of development vs climate change That is not an issue unique to the ocean and cryosphere
18329	1	52	26	53	48	This FAQ is currently not very well structured as it jumpes back and forth between different SDGs and also between how they impact and/or are being impacted by ocean and cryosphere changes. [APECS Group Review, Germany]	Accepted: Restructured to take different aspects of climate change and SDG interactions a groups of similar challenges.
18331	1	52	26	53	48	To make this section easier to follow it would help to always spell out what the specific SDG stands for (not only the number). This is done for some but not everywhere. These terms could then also be formatted consistently (e.g. italics). [APECS Group Review, Germany]	Accepted - text changed
16263	1	52	26	54	6	The authors have to be commended for assessing the implications of changes in ocean & cryosphere for the SDGs in this FAQ. This is crucial information that has also been requested as part of the adopted Chapter outline. It is strongly recommend to elevate key SDG findings to the ES so that the information can potentially be used in the SPM. [Alexander Nauels, Germany]	Accepted -SDG information is now available in the section - why this report?
26849	1	52	26	54	6	This FAQ is misplaced in this chapter as there is no in-depth conversation of SD in Chapter 1. Is there another chapter where this should reside? [Ko Barrett, United States of America]	Rejected: SDGs are discussed in all the chapters. Chapter 1 introduces the concept and
32873	1	52	26	54	6	Typos in FAQ 1.2: Several instances of "SDG" being replaced with "SGD." The associated figure on page 1-54 should be modified so that the individual tiles with the Sustainable Development Goals are easier to read. [Government of United States of America, United States of America]	Accepted: Thanks. The two typos have been corrected. The figure has been modified.
22449	1	52	33	53	30	Suggest clarifying this section. There is a repeat of the impacts on ocean acidification on calcifiers, and an absence of information on the impacts of pH on the marine ecosystems including: reproductive health, organism growth and physiology, species composition and distributions, food web structure and nutrient availability. [Government of Australia, Australia]	Accepted: The reorganization addresses this concern. The cases presented are explicitly illustrative, not exhaustive, and the repeated use of acidifaction is removed
14929	1	52	34	52	38	Climate change and its negative implications are a source of conflict and touch upon aspects of social justice. Therefore, please consider to also include the SDG 16 (Peace, Justice and Strong Institutions) and the negative impact of climate change implications on that. [Government of Germany, Germany]	Accepted: SDG 16 has been already included.
16483	1	52	40	52	42	Knowing that seasonal snow cover change assessment is difficult, it cannot be ignored as a major driver of water problems in mountains and Arctic reagions. [Georg Kaser, Austria]	Noted Thanks.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 1							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16709	1	52	40	52	42	Not only glacier shrinkage but snow cover reduction probably represents a far greater therat to water availability from the mountain cryosphere. Glaciers are more iconic, but their actual role is far less than snow in terms of providig water resources downstream (see Chapter 2 and Armstrong et al., 2018 https://doi.org/10.1007/s10113-018-1429-0) [Samuel Morin, France]	Noted Thanks
23053	1	53	0	54		Give examples of local knowledge : fishermen, people doing aquaculture, coastal tourism, mountain farmers… I find the FAQ very abstract. Think of a high school student reading it : what is the key message, what do we expect the person to get from it? I also think that this FAQ should also convey the sense of sharing science knowledge and merging it with the other forms of knowledge (which is linked to perception, climate literacy, social learning). [Valerie Masson-Delmotte, France]	Rejected: This is an entire FAQ on knowledge systems and how they ae used. To add those messages into this FAQ would take much mor space and diffuse the focus of the answer. Greater specificity has been added about changing availability of fish to fisheires. Because the DETALS of every impac tof climate change on individual SDGs is locally specific, unfortunately the answer has to stay fairly high level.
8797	1	53	15	0		Consider removing comma after 'livestock' as it is not necessary [Nina Hunter, South Africa]	Accepted: text revised
18333	1	53	16	53	19	In the Arctic there could also be positive effects on food security resulting from permafrost thaw as more land becomes available for farming. [APECS Group Review, Germany]	This comment has been passed to chapter 3 who will look into it.
16485	1	53	17	53	17	as well as decreases in seasonal snow cover extent and duration [Georg Kaser, Austria]	Accepted. Text revised to include these elements.
21595	1	53	17	53	17	"and thawing permafrost" permafrost thaws, but the ice in it melts [Stephan Gruber, Canada]	Accepted. Text revised.
8799	1	53	18	0		Consider changing 'bringing' to 'resulting in' [Nina Hunter, South Africa]	Accepted: thanks
17321	1	53	19	53	19	Insert "Indigenous" before "communities" here to qualify appropriately. [Joanna MacDonald, Canada]	Accepted: word Indigenous inserted
4297	1	53	21	53	23	To say that "long-established fisheries may decline" is not really saying much, and also it is not demonstrated in the report (as far as I know the report focuses on catch potential as a whole). It woul dbe better to say that long-established fisheries may change productivity and distributions, to make it more neutral. [Manuel Barange, Italy]	Accepted: text changed
32615	1	53	21	53	27	might be worth noting how many coastal communities obtain a large percentrage of their protein via local fishing. this would enhance this point about food security and climate change [Kim Cobb, United States of America]	Rejected: Thanks for raising this point. However, we coudlnt find reliable data at the global scale which can give us this information.
8805	1	53	30	53	31	Compare to lines 40 to 43 - needs to be consistent. Consider inserting 'SDG' before the number in lines 30 to 31. [Nina Hunter, South Africa]	Accepted: Corrected – thanks
8801	1	53	31	0		wellbeing' to start with capital letter for consistency [Nina Hunter, South Africa]	Accpeted: Thanks, corrected
11631	1	53	32	53	35	It is necessary estimate the cost of these measures. [Government of Mexico, Mexico]	Rejected: Outside the scope of this report
4981	1	53	33	53	33	Won't relocation of exposed communities also be a form of response? [Debra Roberts and Durban Team, South Africa]	Accepted: Text change
16711	1	53	37	53	37	Typo "SGDs" insteal of "SDGs" [Samuel Morin, France]	Accpeted: Corrected – thanks

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15437	1	53	37	53	38	The first sentence on limits to adaptation does not seem to be logically followed by the rest of the paragraph, which in fact talks about mitigation as first option to reduce risks, and adaptation efforts and ways to increase resilience. Consider revising [EUCE, Belgium]	Accepted - text changed
8803	1	53	38	0		Wouldn't the term 'stop' or 'prevent' be better than 'reduce' since the reference is to mitigation? [Nina Hunter, South Africa]	Rejected: Stop is policy prescriptive while reduce is suggestive. We do not use policy prescriptive language.
13787	1	53	38	53	38	"climate warming": climate change or global warming? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accpeted: Corrected – thanks
15439	1	53	44	53	46	It is not clear why investment in social and physical infrastructure in support of adaptation would enable only the poor to participate in Sustainable Development - such investment would enable all to meaningfully engage. Suggest removing reference to the poor, or rephrasing to indicate that other groups of citizens would also benefit from such measures. [EUCE, Belgium]	Noted - It would help the poor much more than the rich and so if governments are looking at adaptation as a strategy for poverty reduction, this could be the
24343	1	53	46	53	46	delete hypen between climate and resilient at the end of sentence. I'm assuming throughout all IPCC report climate resilient development pathways is the preferred usage. [Philippus Wester, Netherlands]	Accepted: Corrected – thanks
25403	1	54	0	0		all this FAQ offers e very instrumental view of IK as being about information and does not really capture how seeing the world in different ways can help us understand humand and our relationship with nature as well as work together to develop integrated solutions. Different outlooks on what causes climate change as well as possible consequences and solutions are important. [Rehema White, United Kingdom (of Great Britain and Northern Ireland)]	FAQ removed
34243	1	54	0	54		Figure 1: the figure can be more elaborated in order to show better the possible relations betwen the SDGs and the the topic. As it is it does not provide much information. [Maria Jose Sanz Sanchez, Spain]	Accepted: Figure has been changed
1529	1	54	1	0		I find this figure less helpful than a table. I find the text difficult to read even when zoomed in and don't understand what the lines are supposed to mean. I would suggest making a table or perhaps a venn diagram or circle-based plot. I also cannot tell if the gradient color is aesthetic or significant. [Jacinta Clay, United States of America]	Accepted: Figure has been changed
31583	1	54	1	0		FAQ 1.2, Figure 1. If the color gradient within the box has a meaning, then this needs to be explained somewhere. Otherwise, you may remove the gradient. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted: Figure has been changed
18335	1	54	3	54	3	FAQ 1., Figure 1, does not convey much information and could be impoved to specify what the fundamental linkages/direct impacts are. The fontsize for the different SDGs is currently too small. [APECS Group Review, Germany]	Accepted: Figure has been changed

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18263	1	54	11	0		FAQ 1.3. Sometimes "Indigenous" is capitalized and sometimes it is not. The choice of one or the other is political (more than just grammatical) so I suggest that the authors consider both options carefully before deciding on one, and then use it consistently throughout the report. [APECS Group Review, Germany]	FAQ has been removed
13789	1	54	11	54	41	Not sure a FAQ plus 6 pages on indigenous knowledge is needed. Suggest this is deleted to save space or the previous 6 pages are cut down. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	FAQ has been removed
16713	1	54	11	54	41	The presence of a FAQ on IKLK is very surprising and is in contrast to LAM3 decision. To me this is clearly NOT a Frequently Asked Question, although this is an interesting question. Clearly, the concept of a FAQ does not apply to this question here and thus this FAQ should be dropped and replaced by another Frequently Aqked Question, from the list which was discussed at LAM3 and from whom some *truly* *frequently* asked questions were not retained. [Samuel Morin, France]	FAQ has been removed
25977	1	54	11	54	41	I am surprised to see this FAQ and suggest to delete it since it is not a FAQ. There was a process to identify FAQs among the many suggestions including a comprehensive survey. This question is hardly a FAQ; this is also indicated that it is not (neither in any variant) on the list of the survey that went to IPCC Focal Points, member Governments and Observer Organizations and IPCC Bureau Members or on the list of questions that have been suggested by these organization; the question was also not part of the list discussed and endorsed at the CLA meetng after the LAM3 meeting, where for example other questions (quite high on the survey list) were voted down. Many other FAQs although highly rated in the survey were not included and should be consdered for inclusion before this one is included. In addition to the procedural issues, this topic seems sufficiently covered including a comprehensive CC box. [Regine Hock, United States of America]	FAQ has been removed
34241	1	54	11	54	41	FQ 1.3: Although the topic is interesting, is this question of the same level of relevance than the other two?. Shoud be a FQ or will be better place as an information Box. As it is iformlated does not add much substance, it is a very general statement on how important indigenous and local knowledge are that can be applied to any topic including the oceans and cryosphere. [Maria Jose Sanz Sanchez, Spain]	FAQ has been removed

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16793	1	54	11	54	43	FAQ1.3 should be revised. To answer the question it poses, it may not be necessary to delve into any detail about "science" as such at all. Just say sth like "local and indigenous knowledge are knowledge systems that complement Earth System science/research" and then continue to explain the merits of ITK. If you want to keep the current form, please give a more thorough and comprehensive representation of climate science and scientific methods used, clarify how indigenous and local knowledge complements science, and how both approaches have their scope, merits and shortcomings. The phrase in ln 19-20 is not correct, as it omits the important field of Earth System and Climate Modelling. We don't think that an absolute statement such as "scientific knowledge doesn't tell the whole story" is helpful, as it could be misconstrued as discrediting the validity of scientific findings, which is of course not the intention of this FAQ. There are also ample examples by now where, e.g., indigenous knowledge of weather patterns has been included into climatic research; those examples should be cited to avoid the impression of conflicting knowledge production systems. The question of scale needs to be taken up in this FAQ. In general, the "response" part should get some more attention, and examples from the area of Ocean and Ice would be helpful. [Government of Germany, Germany]	FAQ has been removed
18283	1	54	14	54	15	delete "… the frozen parts of planet Earth, none as …" [APECS Group Review, Germany]	FAQ has been removed
18337	1	54	14	54	16	"none" should probably be "known"? [APECS Group Review, Germany]	FAQ has been removed
1531	1	54	15	0		"None" should be "known" [Jacinta Clay, United States of America]	FAQ has been removed
8807	1	54	15	0		none' should be 'known' [Nina Hunter, South Africa]	FAQ has been removed
24819	1	54	15	0		typo: "none as the cryosphere" should be "known as the cryosphere" (?) [Thomas Schuler, Norway]	FAQ has been removed
4347	1	54	15	54	15	Should be 'known' instead of 'none' [The UBern Team Group Review, Switzerland]	FAQ has been removed
4983	1	54	15	54	15	Replace "none" with "known" [Debra Roberts and Durban Team, South Africa]	FAQ has been removed
24345	1	54	15	54	15	replace "none" with "known" [Philippus Wester, Netherlands]	FAQ has been removed
28341	1	54	15	54	15	none as? Do you mean known as? [Anne GUILLAUME, France]	FAQ has been removed
32875	1	54	15	54	15	Should read "known as the cryosphere…" (i.e., change 'none' to 'known'). [Government of United States of America, United States of America]	FAQ has been removed
28343	1	54	17	54	17	stores? Isn"t that a bit too commercial as a vision? I woudl rather read sources of information or information mines. [Anne GUILLAUME, France]	FAQ has been removed
28345	1	54	22	54	22	and dependence? Do you mean and dependent? [Anne GUILLAUME, France]	FAQ has been removed

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17323	1	54	23	54	24	The sentence "This knowledge is referred to as either Indigenous knowledge or local knowledge." is worded in a way that could imply these knowledge systems have the same definition and are synonymous. Reword to make clear that they are distinct from one another. [Joanna MacDonald, Canada]	FAQ has been removed
17325	1	54	26	54	28	This is an incomplete definition of Indigenous Knowledge. For a full definition as understood by all Indigenous participants of the Arctic Council, authors could use the following: Indigenous Knowledge is a systematic way of thinking and knowing that is elaborated and applied to phenomena across biological, physical, cultural and linguistic systems. Indigenous Knowledge is owned by the holders of that knowledge, often collectively, and is uniquely expressed and transmitted through indigenous languages. It is a body of knowledge generated through cultural practices, lived experiences including extensive and multi-generational observations, lessons and skills. It has been developed and verifi ed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. [Joanna MacDonald, Canada]	FAQ has been removed
18339	1	54	26	54	31	From this paragraph it does not become clear what the differences between Indigenous, local and scientific knowledge are, as all are described to be evidence-based and empirical. [APECS Group Review, Germany]	FAQ has been removed
8809	1	54	27	0		insert 'one' before 'generation' [Nina Hunter, South Africa]	FAQ has been removed
32877	1	54	27	54	27	Should read "from one generation to the next," [Government of United States of America, United States of America]	FAQ has been removed
25645	1	54	41	0		On line 54 of FAQ1.3,signature frameworks of socio ecological resilience may be included(what survives disasters,for indigenous knowledge has led long term sustainability of communities in fragile enviroment). [Government of India, India]	FAQ has been removed
29159	1	63	4	63	7	Please be so kind to correct the reference by the right ref "Lavrillier, A. and S. Gabyshev, 2018: An emic science of climate. Reindeer Evenki environmental knowledge and the notion of an “extreme process”, Études mongoles et sibériennes, centrasiatiques et tibétaines [Online], 49, Online, URL : http://journals.openedition.org/emscat/3280 ; DOI : 10.4000/emscat.3280" [Alexandra LAVRILLIER, France]	Accepted. Reference corrected.

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28347	1	70	1	71	26	I suggested earlier that "The figure caption would read better if some elements were moved to the Appendix, and to start with, all the refrences, and may be the exact calculation of the spatial coverage. A name should be given to each panel, (A) and (B) if nothing better ('this will help reading the Appendix). " Then please start by mentioning the page of the Figure 1.3. It should then be better to use (A) and (B) than lower and upper panels 'in my fire-rst readin I thought that lower panel meant the bottom figure of the lower panel. This will help to convey at this stage the main points." [Anne GUILLAUME, France]	Noted: the figure caption has been improved. The supplementary material is more clearly labelled to make it clear that SM1.4 supports Figure 1.3
28349	1	70	6	70	7	I would suggest to start a new sentence, and explain better here the 3°x3° box. The colour scale gives the spatial coverage in percentage calculated as ...., from pale blue (0 to 5%) to dark blue (75-100%). [Anne GUILLAUME, France]	Rejected: we don't feel that it is neccessary to explain the colour scale, as the scale bar does this.
8811	1	70	7	0		Remove 'are' as it is repeated in the first line of each example [Nina Hunter, South Africa]	Rejected: feel feel that the wording is clear, and "are" is not at the start of each example.
11393	1	70	17	70	17	I think it is more appropriate to use hue change colormap instead of anomaly based colormap [Anson Cheung, United States of America]	Rejected: we don't feel that this is neccessary for Figure SM1.2. By using two colours it is easier to distinguish at 10% levels. We note that the main figure (Figure 1.3) does use a single hue but with fewer categories.
28351	1	70	21	70	22	"and is adjusted for the changing....levels". I find it quite obscure. May be start a new sentence and explain. [Anne GUILLAUME, France]	Accepted: sentence has been split in two and clarified
28353	1	70	28	70	29	"and the low level.....open ocean. I find it quite obscure. May be start a new sentence and explain. [Anne GUILLAUME, France]	Accepted: text has been clarified
8813	1	70	29	0		Should 'siting' read 'sighting' instead? [Nina Hunter, South Africa]	Taken into account: no, this is as in "sites" where tide guages are located. Nevertheless, we have reworded the sentence to improve clarity
23055	1	71	0	73		See my earlier comment on the need for information in the chapter (not appendix) helping the reader to connect RCPs, time horizons, and levels of warming. [Valerie Masson-Delmotte, France]	Accepted: This has been resolved with the addition of Cross-Chapter Box 1 (scenarios).
8815	1	71	9	0		Replace semi-colon with colon as a list follows [Nina Hunter, South Africa]	Accepted: change made
28355	1	72	1	72	10	I could not understand the link with the previous paragraphs and could find a reference to this a reference to this figure in this appendix. is there a "Scenarios and Pathways" missing in the list of subject in thios Appendix? Is this still supp-lementary material to Fifgure 1.3? Also, please try to adapt the figure so that one can grasp the main message WITHOUT reading rhe caption + may be explain radiative forcing and [Anne GUILLAUME, France]	Noted: The supplement has been re-numbered, and it has been made clearer which section of the main chapter each part of the supplement supports. This section is now SM1.2, and supports the new Cross-Chapter Box 1 on Scenarios. We believe that this new cross-chapter box provides the improved clarity requested by the reviewer.
8817	1	73	5	0		There is a space between 'SRES B1' and the comma [Nina Hunter, South Africa]	Accepted: correction made

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29613	1	73	23	73	23	The word "may" needs to be stricken from the report--it can mean anything and is not part of the IPCC lexicon. This is the first place I have spotted it, but the document needs to be scrubbed to get rid of it--the IPCC lexicon needs to be use. And on this finding, a much more forthright statement needs to be used--there will be species going extinct, due to ocean acidification, warming, changes in competition for nutrients, ocean circulation, and so on. [After writing this comment, I saw a number of other appearances of "may", "might", etc. in this section; from personal experience, it is really important to use the IPCC lexicon consistently as use of undefined words such as these can lead to very different interpretations by readers (1% to 99% likelihood) that can end up causing quite significant confusion. Really try to avoid such terms. [Michael MacCracken, United States of America]	Noted: the text of the chapter has been carefully reviewed and revised.