SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers

Comment id	Chapter	From page	From line	To page	To line	Comment
152	SPM	0	0	0	0	Throughout the report impacts are described in relation to RCP2.6 and RCP8.5 scenarios. This is ok, because the many studies available for these scenarios. But the last Special Report of the IPCC had a focus on 1.5oC scenarios and neither of these two scenarios are comparable to those 1.5 scenarios. But readers probably would like to understand the difference at least of the RCP2.6 and the 1.5 oC scenario. It is suggested to include a box or a footnote to describe the difference, e.g. with respect to cumulatice CO2 emissions of a 1.5 degrees scenario and a RCP2.6. [Government of Austria]
672	SPM	0	0	0	0	Please define in the glossary (as it is done in Chap 4, 4-86): - retreat (including migration, displacement, relocation) - accomodation - advance -protection (with hard protection and sediment-based protection) For example p.12, l.41: "Retreat" is one response to sea level rise, but it is not intuitive for non-scientific readers. [Government of France]
826	SPM	0	0	0	0	General comment: The SPM is well organized and well written. Findings are properly addressed and clear in general. It reflects in a balanced way the content of the underlying chapters. We would like to thank the authors for the substantial work achieved to produce this final governmental draft, and for the consideration given to comments from the previous reviews. Nevertheless, we have some doubts about the readability of many messages by policymakers. [Government of France]
828	SPM	0	0	0	0	General comment Figures are relevant but dense All the SPM figures convey as important as dense information. We welcome the great synthesis of literature provided there, but we would like to draw attention on the readability of the figures: they convey a very large amount of information but it may be difficult to reuse them in other contexts as they are currently, especially in presentations. Should they not be simplified, it would be very convenient to produce them at very high resolution and to develop and give access on the IPCC web site to comprehensive sub figures and their captions. We invite the authors or the TSUs to consider how up-to-date publication tools, such as hyper links, animated figures, videos, might help to fully exploit the content of the figures. [Government of France]
830	SPM	0	0	0	0	General comment on nature-based solutions : Nature-based solutions (NBS) are mentioned on several occasions in the SPM, but a comprehensive strong message in this regard is missing. For example, the following elements could appear more clearly: - Ecosystems, and thus their protection, sustainable management or restoration through nature-based solutions are crucial to adaptation and resilience to climate change impacts (regarding oceans in this special report); - NBS can have an increased impact when deployed at large scale; - Compared to hard protection solutions, NBS are reversible; - NBS bring co-benefits in terms of: biodiversity strengthening; improvement of water and air quality, health. Implementing nature-based solutions is a long-term process. Thus, the SPM could also specify that it is preferable to implement such solutions as far ahead as possible. [Government of France]
832	SPM	0	0	0	0	General comment: We regret that the effect of solar radiation management on ocean acidification is not mentioned in the SPM. If we were to limit global warming using solar radiation management, it would not stop the ocean acidification and its consequences. Though the current review concerns the SPM only, we would like to raise an issue with the following sentence from chapter 5-123 : “The use of other CO2 removal techniques (negative emissions) such as ocean fertilization (Section 5.5.1.3), or solar radiation management, without CO2 emission reductions; both approaches would worsen ocean acidification (Williamson and Turley, 2012; Keller et al., 2014a). » Indeed, it seems to us obvious that ocean fertilization would limit the CO2 concentration in the atmosphere and thus limit the acidification of the ocean. [Government of France]
834	SPM	0	0	0	0	We appreciate the use of symbols to identify the scope of individual messages, which make the reading easier. However, the symbol of the ocean can lead to confusion. The graphic displaying a coral is a bit reductive. A symbol with the same wave, plus a fish may be more adequate. [Government of France]

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Comment id	**Chapter**	**From page**	**From line**	**To page**	**To line**	**Comment**
836	SPM	0	0	0	0	Impacts on human communities 1. Especially in the inter-tropical area, the shift in stocks distribution will impact coastal communities. In B8. the projected impacts of climate change on fisheries may be too quickly presented, and comes with thirteen medium confidence out of thirteen confidence language. 2. We would like to see a message on the impact on human migration. [Government of France]
838	SPM	0	0	0	0	General comment: We suggest developing further the part on projection about permafrost, highlighting thresholds and sensitivity, with an explicit reference to 1.5 and 2°C warming. [Government of France]
840	SPM	0	0	0	0	General comment: We suggest giving more information about sea level rise beyond 2100. As it would be difficult to introduce in figure SPM1, we suggest adding the information in B9. [Government of France]
842	SPM	0	0	0	0	General comment: We suggest reintroducing the topic of legislation as it was done in C3.5 from the previous SPM. We suggest developing even further former paragraph C3,5 as legislation is essential to coordinated governance. [Government of France]
844	SPM	0	0	0	0	General comment: We suggest including much more references to 1,5°c and 2°c warming levels. It would make the SPM easier to read for policymakers, and would reinforce the links with SR1.5 and the Paris agreement's goals. More generally, we think that there are not enough messages in the SPM presenting the current knowledge on the warming thresholds separating reversible from irreversible impacts. [Government of France]
846	SPM	0	0	0	0	General comment: A paragraph dealing with the capacity of the ocean to continue to be a carbon pump in the future should be included. It is for example addressed in chapter 5, p5-52. [Government of France]
850	SPM	0	0	0	0	Part C could be reinforced. [Government of France]
852	SPM	0	0	0	0	General comment: Please check the consistency of paragraph B5.2 and B5.3 as the projected Arctic NPP currently differs from one paragraph to another. Please check the consistency with chapters and consider revising in order to be closer to current knowledge. [Government of France]
854	SPM	0	0	0	0	General comment: To catch the reader's attention, please specify in the SPM the difference between: - ice sheet and sea ice - ice sheet and glacier For example, it is needed to be clearer that B1 is not dealing with ice sheets as some could read that glaciers include ice sheet, especially because B1.1 explicitely mention "Antarctic and Greenland". It would be better and less confusing to add a note somewhere [Government of France]
856	SPM	0	0	0	0	General comment: SDG are little addressed through the SPM even though 2 SDG directly deal with the SROCC topics (SDG 13 and SDG 14). Links could be made along the SPM. [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
1160	SPM	0	0	0	0	The Chinese government thanks the Bureau members of Working Groups (WGs) I and II of the Intergovernmental Panel on Climate Change (IPCC), the lead authors of the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) and the Technical Support Unit (TSU) of WG II for their efforts in preparing this report. In order to further enhance the science, integrity and balance of an IPCC assessment, the Chinese government has made the following comments on the Summary for Policymakers (SPM) of SROCC in the hope that they will be adopted in its revision process. 1. Regular use of scientific terms. As a scientific report on oceans and cryosphere, the accurate use of technical terms is an important aspect that reflects its science. However, inaccurate concepts and irregular use of terms are found in the current report. For example, the concept of cryosphere is not accurate; "High Mountain" and "Mountain" are mixed; and "snow cover" and "seasonal cover" are mixed. It is suggested that the full text of the report be revisited and corrected. 2. Consistency of findings between the SPM and the underlying report. There are many expressions and data in the current SPM that are inconsistent with the underlying report or many findings that fail to put across the underlying report accurately. It is suggested that the SPM be revised as a whole to ensure its consistency with the underlying report. 3. Expression of confidence and uncertainty. There are such problems found in the report as irregular use of confidence level for key findings or inconsistency with the underlying report in this connection, which need to be further checked. 4. Length of the report and readability of its figures and charts. The current SPM is much larger than that determined by the Panel session. To provide policymakers with more accurate and useful information, it is suggested that the key findings be further condensed and the length reduced. At the same time, some figures and charts, which are too complex, are suggested to be further streamlined for an easier readability. [Government of China]
1442	SPM	0	0	0	0	Add box that explains RCP 2,6 and RCP 8,5 in a simple manner. [Government of Denmark]
1446	SPM	0	0	0	0	Language of the report is very technical. This impeeds readability and stands in the way for the overall take home messages. [Government of Denmark]
3084	SPM	0	0	0	0	Length & Readability: The SPM as currently drafted is very long and detailed. Efforts should be made to streamline the SPM so as to focus on high-level concepts and findings that are most relevant to the policy-maker audience. Those interested in more detail can be directed to the underlying chapter via specific references. The Introduction of the Technical Summary is a good example of how this can be achieved. [Government of Canada]
3090	SPM	0	0	0	0	Consistency with SR1.5: There are places in the SPM (notably with regard to text on ice sheet instabilities (B3.4) and projected loss of coral reefs (B6.4)) where inconsistency in messaging between the SR1.5 and SROCC is apparent. The authors of the SROCC SPM need to be very clear if this is because new literature has led to a reassessment of findings from the SR1.5. If not, then the messaging should be made consistent. [Government of Canada]
3094	SPM	0	0	0	0	Calibrated language: We have a number of general concerns about how confidence levels are used in the SPM. There are a number of places where the confidence level given either does not appear in, or does not match that given in, the specific sections of the report that are cited. On occasion, the confidence levels appear in the chapter ExSumm but not in the underlying chapter. There are many instances where confidence language is inappropriately applied to what are essentially factual statements. These cases need to be rectified as otherwise the confidence qualifiers lose their meaning and impact. In addition, there are places where it is unclear to what part of the sentence the confidence qualifier applies to; this is especially troublesome in long, compound sentences. [Government of Canada]
3096	SPM	0	0	0	0	Icons: Canada did find the use of paragraph content icon useful and we acknowledge the effort to facilitate the usability of the content. It is recommended, however, that the icons themselves be changed, notably the use of snowflake for Polar Regions and Coral for Oceans was a bit confusing. Perhaps a Polar Bear Icon for Polar Regions and a Wave Icon for Oceans would be a preferable choice. [Government of Canada]
3098	SPM	0	0	0	0	Language: Recommend that where appropriate, use of 'is shrinking' and similar phrases be avoided. If a general statement is being made, to convey ongoing change, this phrasing is appropriate. But where historical changes from observations are being reported, the past tense should be used in keeping with what the data supports (i.e. has shrunk/has declined). [Government of Canada]
3410	SPM	0	0	0	0	Figures: It is recommended that Figure TS.2 be brought forward into Section A of the SPM. It is a great example of a simple graphic that is easily understood by a non-technical audience and conveys multiple points of information without the need to read the description. [Government of Canada]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3584	SPM	0	0	0	0	A word search shows that "Arctic" is mentioned 63 times, while "Antarctic" is mentioned only 22 times. The SROCC and the SPM should strive to collect and reflect more scientific output on Antarctica, striving to overcome the scientific gap between North and South. [Government of Brazil]
3586	SPM	0	0	0	0	The relation between the impacts of physical and ecosystem changes in Antarctica and the Southern Ocean, on the one hand, and the climate system and ecosystems of South America and the South Atlantic, on the other, is missing. [Government of Brazil]
3588	SPM	0	0	0	0	it maybe consider this reference :in article "Evolutionary trend of the Gorgan Bay (southeastern Caspian Sea) during and post the last Caspian Sea level rise" Mohammadreza Gharibrezaa-Ali Nasrollahi-Amin Afshar-Ata Amini-Hossein Eisaeid-July 2018-https://doi.org/10.1016/j.catena.2018.04.016 World-class climate scientists and Physical oceanography recognize the Caspian Sea as a natural dynamic model of fluctuating water level developments.The annual rate of change in its SLR, which is usually more than 100 times the ocean surface fluctuation.Different hydrological behavior against weather and meteorological phenomena. The level of the Caspian Sea's water level declined about -29 meters from 1930 to 1978 with a rapid decline. after that,until 1995 with an increase of 2.5 meters, the level of the Caspian Sea surface reached to -26.5 meters.Again, the Caspian Sea suffered a widespread recovery between 1995 and 2017.And its level of surface Decreased about 1.4 meters.Sometimes the speed of the sea level has reached more than 20 cm per year, and sometimes it has risen to more than 14 cm a year.So the Caspian Sea Dynamically fluctuates the level of water level is very different.This has led to a change in the severity of the physical vulnerability of its coastal land to erosion hazards. [Government of Iran]
3590	SPM	0	0	0	0	it maybe consider this reference : Maryam Irani,Alireza Massah,Asghar Bohluli,Hamid Alizade,2018,The elevation of the Persian Gulf and Oman Sea is influenced by climate change in the coming periods,Journal of Natural Geography Research. Sea level changes are different on a global scale. Sea level in the southern coast of Iran will increase on a local scale more than the global scale, and in the 21st century there will be an increase in sea level from 29 to 93 cm in south of Iran. [Government of Iran]
3592	SPM	0	0	0	0	it maybe consider this reference : Javid Pegah, Naser Farrokhi, Mohammad Reza Bakhtiyarizadeh and Siamak Behzadi, 2018, Review of global warming on coral ecosystems depletion of the world and the Persian Gulf, National Conference on Climate Change and Aquatic Ecosystems. Persian Gulf corals have a high tolerancein threshold in comparison with the corals of other areas and can tolerate temperatures higher than 36 C, so they have been damaged less than the others. [Government of Iran]
3594	SPM	0	0	0	0	it maybe consider this reference : Yazdanpanah, Maryam; Ali Nasrollahi; Mohammad Reza Shokri and Keyvan Eludali Khaneghah, 2018, Heating Effect on Macrobenthes of the Persian Gulf (Bushehr), National Conference on Climate Change and Aquatic Ecosystems. An increase of 3 degrees of water temperature due to global warming can affect the structure of the diversity and frequency of macrobenthoses in the Persian Gulf and increase their abundance in the next century. [Government of Iran]
3596	SPM	0	0	0	0	it maybe consider this reference : Sidamin Allah Taghavi Motlagh, 2018, Evaluation of Vessel Species Vulnerability in Persian Gulf and Oman Sea Under Climate Change Based on Demographic Parameters, National Conference on Climate Change and Aquatic Ecosystems. Sea ecosystems are getting warmer and less oxygen and eventually becoming more acidic. Aquatic species with a high degree of inherent vulnerability include: Cetera, Fish Tuna, Fish Eaters, Catfish, Sharks. [Government of Iran]
3598	SPM	0	0	0	0	it maybe consider this reference : Saeedeh Manjbari Mohsen Farzin, 2018, Investigating Climate Change Detection on the Urmia Lake Basin, National Conference on Climate Change and Aquatic Ecosystems. Urmia Valley is lined with natural salty lakes in the center of a drainage area. Among the world's lakes, it is the 20th largest salt lake in Iran and the Middle East. The importance of Lake Urmia and its drying process in recent years, its causes and methods of preservation have become increasingly important. The cause of this phenomenon can be explained by two main reasons. The most important one is climate change. [Government of Iran]
3600	SPM	0	0	0	0	it maybe consider this reference :"An overview of Iranian mangrove ecosystems, northern part of the Persian Gulf and Oman Sea"(MohammadAli Zahed-FatemehRouhani-SorayaMohajeria-Farshid Bateni-Leila Mohajeri) August 2010, DOI: 10.1016/j.chnaes.2010.03.013 Iranian mangrove forests occur between 25˚ 11 to 27˚ 25, in the north part of the Persian Gulf and Oman Sea. The areas of Iranian mangrove forests are almost 10700 ha which maximum area 67.5 km 2 occurs between Khamir Port and northwest of Qeshm Island, and minimum area 0.01 km 2 in Bardestan estuary. Only two species of mangrove include Avicennia marina from Avicenniaceae and Rhizophora macrunata from Rhizophoraceae are found in the Persian Gulf. A. marina specie is dominant specie in these forests and Rh. macrunata specie just is found in Sirik region. Overexploitation of mangrove leaves and oil pollution are the main destruction factors in this region Persian Gulf has high salinity, with a salt content of 38 − 50 g/L (Parvaresh et al., 2011). Petroleum hydrocarbons are de- tected in proximity (Zahed et al., 2010). The range of surface tem- peratures of water in the Sirik mangrove forest on the shore of the Gulf of Oman, varies from 23 °C in winter to 32 °C in the summer. [Government of Iran]

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3602	SPM	0	0	0	0	it maybe consider this reference: "Distribution and Abundance of the Corals around Hengam and Farurgan Islands, the Persian Gulf "Rezai, Hamid Samimi, Kaveh Kabiri, Keivan Kamrani, Ehsan Jalili, Mahshid Mokhtari, Mohammad, September 2010,The percentage cover and distribution of scleractinian corals were in the Persian Gulf: In Farurgan Island, hard coral cover was concentrated in the west and north-west of the island, while in Hengam it was mostly concentrated in the eastern side of the Island. Mean hard coral cover was 25.91% (± 5.80) and 48.47% (±1.36) in Farurgan and Hengam Islands, respectively. There was a significant difference ($p<0.01$) in hard corals coverage among different reefs in each island. Other benthic life forms showed similar patterns with significant differences ($p<0.01$) among reefs. It was observed that the predominant hard coral forms were massive (Porites) in Farurgan Island, whilst those in Hengam Island were mainly branching corals (Acropora). Acropora corals are the dominant corals of the Persian Gulf. The result of PASTAKIA analytical model was show that Iranian side of the Persian Gulf can be divided to 5 zone with weak similarity. Also, It is possible each of area have overlapped with neighboring zones. Conference Paper ," Assessment of climate change effects on the Persian Gulf coral reefs ecosystems, using by Pastakia Analytical Model", Mahnaz Rabbaniha,October 2013 Global warming's affect on the Persian Gulf coral reefs: Acidification: The third and in many respects the greatest concern in the longer term, is that global change is causing the world's oceans to become more acidic.Coral loss: There are many causes of local and global coral loss but human-induced climate change is one of the main and undeniable threats. Climate change is having negative effects on coral populations via at least three mechanisms. Coral disease: Ocean warming can also indirectly kill corals by magnifying the effects of infectious diseases, which are one of the primary causes of coral loss, particularly in the Caribbean Coral bleaching: First, ocean warming is directly reducing coral cover through coral bleaching. Reef-building corals contain plant-like organisms called zooxanthellae that live symbiotically within their tissue. Coral bleaching is caused by elevated sea surface temperatures due to global climate change which the animals cannot cope with Bleaching observations on the Iranian side has also been documented through field observation at Kish, Farur and Hendourabi islands.At Kish Island the results of a survey in 1999 showed that approximately 15% of massive (Favia sp.) and sub-massive coral (Porites sp.) colonies showed bleaching in which typically 70% of each colony exhibited surface bleaching. This might have been the result of high sea surface temperature, which was reported during the years of 1996 and 1998. In 2000 and 2001 however, bleaching was absent or at very low incidence. [Government of Iran]
3604	SPM	0	0	0	0	it maybe consider dis reference :Ehsan Khorsandi, Ahmad Moghaddam,2010,Investigation of the Pattern of Chlorophyll Changes in the Persian Gulf for a 12 - year Period Using Satellite Data and Investigating the Impact of Climate Change on it, Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3606	SPM	0	0	0	0	it maybe consider dis reference : Parisa Sadat e Ashofte, 2010, The Effect of Climate Change on Runoff Using HadCM3 Model and Under Greenhouse Gas Emission Scenarios, Case Study of Corner Basin , Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3608	SPM	0	0	0	0	it maybe consider dis reference :Saeed Jahanbakhsh,Masoome Edalatdoost,2010,Lake Urmia is a classic indicator of the relationship between solar spills and climate in northwestern Iran, Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3610	SPM	0	0	0	0	it maybe consider dis reference :Mahmoud Khosravi, Rabab Norouzi, 2010, Estimation of methane greenhouse gas emissions from livestock activities in Iran, Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3612	SPM	0	0	0	0	it maybe consider dis reference : Ismail Dodanje, Saeed Soltani, Ali Sarhaddi,2010,Investigating the effect of climate change on the process of limiting the flow (minimum flow and flood) in the white water basin of the dam,Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3614	SPM	0	0	0	0	it maybe consider dis reference : Mehri Hashemi Dovin, Ali Akbar Sabzi Parvar,2010, The consequences of the aviation industry in changing the global climate,Fourth Regional Climate Change Conference,IRAN, [Government of Iran]
3616	SPM	0	0	0	0	there is not any describtion about Lakes and the largest lakes in the world, especiall Caspian sea level fluctution and its effects on ecosysten and Coastal human society [Government of Iran]
3618	SPM	0	0	0	0	It may be added to the report that Probability of accurence thef Tropical cyclone will increase in the regions that has not recorded, such as Guno cyclonethat happened in hurmoz Striat and Persian Gulf [Government of Iran]
5430	SPM	0	0	0	0	'The SPM is missing information on the impacts of coastal erosion and saltwater intrusion into the coastal freshwater lens including for small islands. This information should be included. [Government of Saint Kitts and Nevis]
5432	SPM	0	0	0	0	Throughout the report, RCP2.6 is presented as a 'low emissions scenario'. This is policy prescriptive. RCP2.6 is an AR5 below 2°C scenario that may or may not be in line with the strengthened 'well below 2°C' upper limit of the PA. It certainly isn't a 1.5C scenario. For many countries, a scenario that exceeds 1.5°C may not be 'low'. Please rephrase objectively, i.e. as a 66% 2C scenario. [Government of Saint Kitts and Nevis]

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5434	SPM	0	0	0	0	The concepts of loss and damage, incremental adaptation and transformational adaptation should be clarified throughout the report. Incremental adaptation may be performed without loss and damage invoked. If limits of incremental adaptation are reached, loss and damage will occur and responses to loss and damage may include transformative adaptation (such as relocation). Even if transformational adaptation is resorted to before limits to incremental adaptation have been reached, by definition, transformtional adaptation results in a fundamental shift in the values or objectives of a system. Thus, there will be some loss and damage associated with a complete system shift. Failing to differentiate between incremental and transformational adaptation masks the effects of transformation on a system. The report would greatly benefit from conceptual clarity on this point and a clear distinction between incremental and transformational adaptation. [Government of Saint Kitts and Nevis]
5436	SPM	0	0	0	0	Many impacts on ocean and cryosphere go beyond the quite artifical limit of 2100. Not just for ice sheets, but many other systems as well. It is unfortunate that the SPM in its current form does not present those well and therefore at times gives a false sense of limited differences in impacts between RCP2.6 and RCP8.5. Such impacts include sea level rise, ice sheets, glaciers, permafrost melt, ocean acidification and deoxygenation as well as tipping points such as the AMOC or regional circulations [Government of Saint Kitts and Nevis]
5986	SPM	0	0	0	0	The way of describing A2.1 and B2.1 (or other sections in SPM B) needs to be consistent. The observed ocean warming (SPM A2) is described with the heat gain in ZJ or the rate in ZJ/yr while the projected ocean warming is done without any heat content in the same unit (but degree C only). In SPM A2, the observed ocean warming needs to be described in temperature (degree C) as well as ZJ/yr. In SPM A3, the projected ocean warming needs to be described in heat contents (ZJ). [Government of Republic of Korea]
5988	SPM	0	0	0	0	It is necessary to correct the mistyping and expression in SPM like following. (p2, footnote : very likely → very likely; p5, 21 : unabated → unabatedly; p5, 45 : (1979 to 2018) → 1979~2018; p6, 23 : oxygen declines to human activity in tropical regions → oxygen declines in tropical regions to human activity; p6, 28 : change {6.7}. → change. {6.7}; p6, 47 : Zj yr-1 → Zj yr-1; p7, 1 : mm yr-1 → mm yr-1; p7, 4 : SPM.1. → SPM. 1; p7, 25 : abundance → their abundance; p7, 46 : marine species' → marine species; p8, 23 : primary productivity, ecosystem structure → primary productivity and ecosystem structure; p.8, 35 : biodiversity, ecosystem functioning → biodiversity and ecosystem functioning; p9, 17 : mm yr-1 → mm yr-1; p12, 8 : loss oxygen → oxygen loss; p14, 11 : sea ice free Arctic ocean → sea ice-free Arctic ocean; p16, 32 : ocean ecosystem → marine ecosystem) [Government of Republic of Korea]
6032	SPM	0	0	0	0	The period of assessing the mass loss from the Greenland and Antarctic Ice Sheets and their contributions to global sea level rise in Chapter 3 (excutive summary) is different from those described in SPM A (2006-2015). [Government of Republic of Korea]
6034	SPM	0	0	0	0	While the chapter 5 refers to the changing coastal ecosystems and biodiversity, one of the most important coastal wetlands, viz. "tidal flats", has been missing from the whole discussion of the chapter, particularly in 5.3.2. Tidal flats are well recognized coastal wetlands ; 'The Global Wetland Outlook 2018' published by Ramsar has clearly stated that "The largest areas of natural marine/ coastal wetlands are unvegetated tidal flats, saltmarshes and coral reefs, together forming almost 80% of the global total". With omission of tidal flats from the list of the important coastal wetlands would also mislead the readers of the SR5. For example, when the authors state that "Globally, between 20-90% of existing coastal wetland area is projected to be lost by 2100" in the page 5-61 of Chapter 5, people would consider saltmarsh, seagrass meadows and Mangrove forests, but not the tidal flats. Thereafter, we suggest the keyword "tidal flats" should be included in the subchapter 5.3.2. we recommend one paper for this issue published in Nature 2018 of which title is "the global distribution and trajectory of tidal flats" by Murray N.J. et al. (Nature 566, 22-225) [Government of Republic of Korea]

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6036	SPM	0	0	0	0	we ask for correction by confirming that there are some serious description errors in the FGD of the last modified SROCC, which are about 6.4 of Ch.6. In 6-17 page of table 6.2, Yellow Sea/Sea of Japan 2017 was wrong description. One of references, Kim and Han(2017)(Korean manuscript with English abstract) desribed about the MHW on the Yellow Sea and southern coast of Korea, where included in Northern East China Sea, in 2016. Another reference, Tan and Cai(2018) also desribed the significant MHW in the East China Sea in 2016. Korea Meteolorogical Administration(2016), which was also references, was not peer-reviewed paper and international organization report, it was one of national report. Therefore, the correct description is that year is 2016 and regions are Yellow Sea/East China Sea. References shoule be used only for Kim and Han(2017) and Tan and Cai(2018). In the same reasons, Figure 6-3(a) in 6-28 page should also be changed. It should be modified to Yellow Sea/East China Sea 2016 instead of Yellow Sea/East China Sea 2016. Finally, in 6-32 page, "the Yellow Sea/Japan Sea 2016 MHW~" should also be changed. Right expression is "the Yellow Sea/Northern East China Sea 2016 MHW~". For the change of sentence, reference will be changed to Kim and Han(2017) instead of Korea Meteorological Administration(2016). [Government of Republic of Korea]
6078	SPM	0	0	0	0	The report only shows the significant impact of 1.5℃ and does not show the 2℃ impact in order to compare the magnitidude and the differences. [Government of Saudi Arabia]
6080	SPM	0	0	0	0	The report states many figures on the condition of the ocean in this century but does not trasnlate these figures to what extent does that impact the affected region and in what form that impact will be! [Government of Saudi Arabia]
7584	SPM	0	0	0	0	The text includes very little attention to changes in the amount and phase of precipitation. Below are some examples: Page 3, line 38: write: "Retreat of glaciers, thaw of permafrost and increase of rain have decreased the stability of high-mountain slopes" Page 11, lines 13-14: the text is true but the impression that it gives on generally decreasing water quantitty in the Arctic is misleading. On average in the circumpolar Arctic, precipitation has increased during recent decades (Lique et al., 2016; Vihma et al., 2016), which contributes to increasing water quantity in the Arctic, opposing the factors mentioned in the text. [Government of Finland]
7586	SPM	0	0	0	0	We would like to thank the authors for their impressive work and contribution to the IPCC's assessments. In general, the draft is clear and concise. [Government of Finland]
8454	SPM	0	0	0	0	Projections: Many of the projection results are reported in the SPM as 'by 2100'. Sometimes this is appropriate but in a number of cases, this fails to give the reader any sense of what changes are occuring throughout the 21st century. [Government of Canada]
8456	SPM	0	0	0	0	Projections: We would like to see some attention given in the SPM to sea level rise beyond 2100. Currently, there is barely a mention of how sea level will continue to rise beyond 2100. Section C5 addresses the potential for limits to adaptation beyond 2100 and to support this discussion, there needs to be some more explicit information about the long time scales of the sea level response. [Government of Canada]
8458	SPM	0	0	0	0	In general, since we recommend shortening the SPM, we see a number of options for shorterning this start-up Box. See specific suggestions below. [Government of Canada]
8464	SPM	0	0	0	0	Recommend consistency in panel labelling for (d), (h), (i), (k), (l), (m), (n). Either label them all with just the indicator name (e.g. ocean heat content) or add 'change' to all the labels (e.g. ocean heat content change). [Government of Canada]
8466	SPM	0	0	0	0	From a design perspective, it would be tidier to have an even number of panels and to have two columns only. This stylistic consideration is another reason to suggest deleting the population panel. Of the remaining panels, we would recommend deleting the panel showing changes in atmospheric CO2 concentration. [Government of Canada]
8568	SPM	0	0	0	0	In general, there is no reference to the warming of the Pacific Ocean. Such data/information are critical to consider and include as the warming of the Pacific Ocean would impact a lot of Pacific SIDS, especially countries like Kiribati [Government of Kiribati]
8574	SPM	0	0	0	0	The conditions of the El Nino events as they are now in Kiribati are already destructive now in Kiribati [Government of Kiribati]
8580	SPM	0	0	0	0	combined with EL NINO & LA NINA impacts,these would create serious problems for fisheries dependent island countries like Kiribati. This is a major concern for Kiribati [Government of Kiribati]
8584	SPM	0	0	0	0	The capacity of ecosystems, in particular atoll islands, would be seriously impacted [Government of Kiribati]
8698	SPM	0	0	0	0	Low emissions scenario is also critical for low lying atoll nations [Government of Kiribati]
8700	SPM	0	0	0	0	No information on thermal water expansion particles [Government of Kiribati]

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8702	SPM	0	0	0	0	B1: Low emission of GHGs [Government of Kiribati]
8704	SPM	0	0	0	0	B2.5: [Government of Kiribati]
8706	SPM	0	0	0	0	2.7: More studies in the Pacific needs to be reflected [Government of Kiribati]
8708	SPM	0	0	0	0	B3: Major - needs to be identified as significant; small islands and low lying atolls [Government of Kiribati]
8710	SPM	0	0	0	0	B5: El Nino - [Government of Kiribati]
8712	SPM	0	0	0	0	B6: and in particular Islands [Government of Kiribati]
8716	SPM	0	0	0	0	There needs to be clarification on how culture and heritage are included in the societies mentioned here [Government of Kiribati]
8718	SPM	0	0	0	0	C1.1. There needs to include examples from other regions. It is necessary to include examples of small islands, especially low lying atoll nations that have no high islands in their geographical set-up. Examples from PSIDS, especially from low lying atoll nations are important to include also [Government of Kiribati]
8720	SPM	0	0	0	0	It is not just national capacity, but the supporting system is not responding and supportive of addressing our needs to cope/response to climate induced impacts. [Government of Kiribati]
8724	SPM	0	0	0	0	they would comprise under 'high emissions scenarios', we need also to be attentive also to 'low emissions scenario'. Under 'low emissions scenario' it is an important issue for low lying atoll natios in the Pacific region [Government of Kiribati]
8726	SPM	0	0	0	0	C2.1: for low lying atoll islands, there is no choice for movements of populations and species. Network of PAs - this is very much part of the peoples lives, livelihoods and an important sources of major economy. The statement as it is now, need to be strengthened and to include also, people [Government of Kiribati]
8728	SPM	0	0	0	0	C2.2: the inclusion of the words - 'the urgency of actions and ambition to implement EBAs' at the end of the sentence in line 3, page 24 [Government of Kiribati]
8732	SPM	0	0	0	0	C2.3: Need to add: precautionary approach to fisheries management means nothing to pelagic and coastal fisheries mgmgt? Bringing down the emissions is CRITICAL than adaptive mgmgt, as reflected in this statement now [Government of Kiribati]
8734	SPM	0	0	0	0	C2.3: High Confidence Claim: good to coastal fisheries, but in the case of oceanic/pelagic species, this is not very helpful, the sustainable mgmgt of the fisheries would still not helpful to safeguard and retain the pelagic fisheries that are currently found now in the Pacific region, we may end up with fisheries moving polewards [Government of Kiribati]
1306	SPM	0	0	0	0	Luxembourg would like to thank the authors for the present draft of the SPM of the Special Report on the Ocean and Cryosphere in a Changing Climate. The SPM, and in particular the figures have improved from the previous version and we find that the SPM is overall in good shape. [Government of Luxembourg]
1308	SPM	0	0	0	0	We do find that the SPM is quite long in the current state. However we would like to keep the contents as they are, but some sections contain some overlaps. We will point out some possibilities in our specific comments. [Government of Luxembourg]
1310	SPM	0	0	0	0	We are however disappointed that many of the high-level messages do not convey important and robust findings that are reflected in the bullet points below. We will make comments accordingly. [Government of Luxembourg]
1312	SPM	0	0	0	0	We would like to underline the link of this report to the IPCC Special report on Global Warming of 1.5°C. It would be useful to make stronger links between the two reports, in particular when using different scenarios, less weight should be given to high emissions scenarios like RCP8.5 and much more weight to low emissions scenarios in line with 2°C and 1.5°C level as those are most policy relevant in the context of the Paris Agreement. [Government of Luxembourg]
1314	SPM	0	0	0	0	We would like to highlight more information from the underlying chapters in the SPM in particular on greenhouse gas emissions from permafrost thawing and projections of sea level change beyond 2100. [Government of Luxembourg]
1536	SPM	0	0	0	0	The SPM text and figures/tables need to be checked and edited further, as there is inconsistency in presenting the outputs, e.g. the use of units, reference periods, and the use of language (e.g. sea level rise and sea-level rise). [Government of Singapore]
1544	SPM	0	0	0	0	Policy-makers will be looking at the findings presented in the SROCC SPM alongside the AR5 SPM and 1.5SR SPM. It would be useful to include in the startup box a paragraph to explain some lines, or even a table on the main findings which have been updated since AR5. For example in B3, it is stated clearly global sea-level rise projections have been revised upwards since AR5 under RCP8.5 because of larger contribution from the Antartic ice sheet. These are key reference points for policy makers that need to be captured upfront and clearly. We need to understand what figures have been updated, and why. [Government of Singapore]

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1546	SPM	0	0	0	0	On the use of RCPs, 1.5SR SPM does not mention RCPs once, and it is challenging for non-experts to relate the findings in the SROCC with the 1.5SR (which was released only recently in Oct 2018) without going into the technical chapters. Coherence across the AR6 products including the SRs and AR6 is key. It is challenging when findings on one issue are presented and framed differently. Take global mean sea level rise as an example. 1.5SR SPM presents the slr findings as ranges with medium/high confidence while the SROCC SPM presents the slr findings as a mean with a likely range, and no mention of the confidence level. Also, SROCC Ch1 Table CB1.1 states RCP 2.6 relates to global mean surface air temperature of 1deg end-of-century relative to 1986-2005 levels. How do we reconcile the range of 0.28-0.54m of slr under RCP2.6 in the SROCC SPM (B3.1) with the range of 0.26-0.77m of slr under 1.5 deg scenario in the 1.5SR SPM (B2.1)? [Government of Singapore]
1548	SPM	0	0	0	0	1.5 SR SPM (D1.1) states that NDCs collectively are consistent with 3 deg warming by 2100. Which RCP does this correspond to? From SROCC Chapter 1 (Table CB1.1), one can infer that warming from today's NDCs bring us to somewhere between RCP 6.0 (mean: 2.3 deg) and RCP8.5 (mean: 3.7 deg). IPCC may wish to consider including other RCP scenarios in the SROCC SPM text and visuals rather than just focussing on RCP 2.6 and RCP 8.5. This will have inform global ambition. [Government of Singapore]
1572	SPM	0	0	0	0	The SPM is a multifaceted document, wich provides a broad overview of climate related problems of the ocean and cryosphere. [Government of Hungary]
1574	SPM	0	0	0	0	The SPM doesn't address the problem of geopolitical challenges of mountain glaciers which supply inland streams with fresh water. Melting poses a possible risk of water conflicts between countries through water scarcity, and thus must be dealt with. [Government of Hungary]
3086	SPM	0	0	0	0	Figures: The graphs and figures in the SPM are complicated and dense and will be extremely difficult it not impossible for a non-technical audience to decipher. The sub-elements are overly miniaturized and crowded together. We recognize that the graphical presentation of multi-dimensional data is very challenging. Graphs and figures need to be simplified to increase their readability and usability. Perhaps favouring clarity over completeness might be a way to proceed in revising these illustrations. [Government of Canada]
3092	SPM	0	0	0	0	Calibrated language: The joint use of confidence and likelihood statements in the SPM may be confusing for non-technical readers. The use of a footnote to describe calibrated language is ineffective and difficult to understand. It is recommended that the more fulsome explanation of calibrated languages included in the technical summary be moved into or Annexed to the SPM and that sentences use either confidence or likelihood states but not both together. [Government of Canada]
3412	SPM	0	0	0	0	Many of the findings refer inconsistently to underlying forcing scenarios, in some cases only to RCP8.5, in others only to RCP2.6, sometimes both (e.g. B3.2, B4.3, etc.), and sometimes instead qualitatively to "low emissions" or suchlike. While the underlying literature probably sets some constraints, this makes the findings (and cases) difficult to compare and set into a perspective. It would be useful if the results could, as much as possible, refer to comparable scenario cases. [Government of Sweden]
3414	SPM	0	0	0	0	The SPM does not seem to refer to 1.5 degrees very extensively. Has consistency with the IPCC SR15 (or possible inconsistencies due to new findings) been ascertained? [Government of Sweden]
3416	SPM	0	0	0	0	The figures are very rich in information, and very possibly a bit too ambitious. They are in many cases difficult to comprehend and could be streamlined for clarity and for adding "punch" when it comes to the main message to be displayed. In general, clear, lucid, simple figures would be best, rather than overly loaded with very much information. [Government of Sweden]
4516	SPM	0	0	0	0	We would like to reiterate our previous comments: we prefer a very short SPM (max 10 pages, illustrations included) besides the TS. Even if this last version is better than the previous one, the report is difficult to read even by an informed policymaker. It is complex and chaotic. It would help if information was provided on the way the report is structured up front . Also clear headings could be helpful. There is some confusion. According to our policymakers, the present language in the SPM is not more adequate nor appropriate than the language used in the TS. It is still very technical and messages are very diluted although there is a lot of important information in it. We would like to see for example high level messages with respect to risk. [Government of Belgium]
4518	SPM	0	0	0	0	Please explain upfront why most projections, graphs, modelled outcomes etc. stop at 2100. Some policymakers might think that the challenges stop or decrease in 2100. [Government of Belgium]
4520	SPM	0	0	0	0	The link with the 1,5°C SR and the long term target of 1,5°C is missing. This is important for policy makers. [Government of Belgium]
4652	SPM	0	0	0	0	Thank you! We wish to express our gratitude and appreciation to the SPM writing team, the authors of the underlying report, the Co-Chairs and TSUs for their massive efforts in providing the final draft of the SROCC and the second-order draft of the SPM for government review. We fully support the IPCC in its endeavour to provide comprehensive, up-to-date and policy relevant assessments of the current knowledge and best available science. We also wish to acknowledge the scientific community as a whole for their continued and voluntary support. [Government of Germany]

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4654	SPM	0	0	0	0	Streamline, shorten and reduce complexity: We congratulate the author team for a greatly improved 2nd order draft of the SROCC SPM and acknowledge its high quality. Our comments are provided in a spirit of support and cooperation, and aimed at furthering the usability of the SPM for its target audience, while fully respecting the integrity of science. With the audience of the SPM and the upcoming approval session in mind, we would once more strongly urge the authors to shorten the SPM, reduce the complexity of the figures and the level of technical detail provided. We also feel that some of the more general issues we raised during the government review of the SROCC SOD/SPM FOD have not been fully addressed with the current revision, and sincerely hope the author team will be able to incorporate our suggestions when producing the final draft. This concerns i.e. the general narrative of the SPM, more clarity on post-2100 impacts and risks, in particular for sea level rise, use of the reasons for concern framework to display adaptation, and the treatment of abrupt change. [Government of Germany]
4656	SPM	0	0	0	0	Headline narrative: We would like to encourage the authors to further refine the headline statements to highlight those findings that are of most eminent concern to policymakers, being as concrete and specific as possible and avoiding generic statements. Taken together, the headlines statements should provide a summary of the key messages of the SROCC in a conclusive narrative, and should therefore also reflect the key content of the graphics. We would appreciate if the authors could find a way to put some more emphasis on committed long-term changes, such as sea-level rise, the causal link to mitigation and sustainable development, include risks from abrupt change and try to portray a clear sense of the dimension of the observed and projected changes and impacts to a non-expert audience. We'd also recommend to include a stand alone section on extreme sea levels, splitting current B3 into two parts (see our comment on B3 p. 15-14), and a stand-alone section on abrupt change. [Government of Germany]
4658	SPM	0	0	0	0	Risk of abrupt change: We still miss conclusive information and a more convincing framing of the risk of abrupt change and tipping points/threshold behaviour in the SPM and summary sections of the underlying report. FOD SPM Section C stated "Improvements in credibility, trust and reliability in institutions and scientific information on unexpected extremes and abrupt changes are crucial for countries to prepare for such uncertainties and enhance resilience" - this notion has disappeared from this draft SPM, which continues to have very few references to abrupt change. The inclusion of Chapter 6 in the outline of this report clearly highlights the importance both the scientific community and policymakers place on knowledge of (potential) tipping points, abrupt changes, compound events and high risk-low probability events and their anticipation and management. Please make sure that important information such as the potential onset of the WAIS disintegration and its consequence, permafrost feedback, ENSO, AMOC slowdown and other relevant processes get included in the SPM and the headline statements where appropriate. As SOD Figure SPM.4 b has been deleted, the SPM no longer provides a risk assessment for most of the processes discussed in Chapter 6. If the knowledge base is too weak, or findings are inconclusive, this could still be said explicitly in the SPM, informing policymakers about the existence of potential risk from such processes, and levels of uncertainty. We would welcome a standalone section on potential large scale discontinuities and what is known about their onset at different T-thresholds, e.g. as part of a "risk management through mitigation" section under "options" in C. [Government of Germany]
4660	SPM	0	0	0	0	Overshoot: The important issue of temporal and long-term changes resulting from temporary overshoot of the 1.5 and 2C temperature limits, and risk adjacent to peak-and-decline-temperature (and emissions-) pathways seem to be missing almost entirely from the report. It would nevertheless be highly relevant for policymakers to understand the risk of committed changes due to continued high anthropogenic forcing over the coming years, and potential implications for ecosystems and the climate system components relevant to this report of (rapid) increases followed by steep decreases in ambient CO2-concentrations/forcing over the course of the 21st century, as these are plausible scenarios with very specific risks that are not limited to the case of limiting warming to 1.5C discussed in the SR1.5. Please include a reference to committed risk from temporary overshoot into the Start-up box, the relevant risk sections or the "options" section of part C. [Government of Germany]

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4662	SPM	0	0	0	0	Consistency with SR1.5: The SPM hardly references the important outcomes of the SR1.5 and/or specifies outcomes for this temperature threshold, which is surprising given its relevance for many elements of the Ocean and the Cryosphere. We find it unfortunate that the underlying report has failed to incorporate and build upon the findings of SR1.5 in a comprehensive and consistent manner. Instead of reverting to the AR5 and pre-Paris setting of RCP2.6 vs RCP8.5, it would have been preferable to include results for RCP1.9 and from the SR1.5 to evaluate outcomes for low stabilization pathways more closely. It is important to avoid the impression that the SROCC ignores the SR1.5, but rather this report should build on the findings of SR1.5 with a consistent approach and clear references to its findings. We'd encourage the authors to include relevant findings on 1.5C where there is material in the underlying chapters, e.g. for coral reefs, AMOC, SLR, coastal risk and ENSO. It would be helpful to clarify the relationship between the two reports in the introduction, and mention this important threshold explicitly in the introductory box and/or in section B and C. While it is clear that this report can not repeat all important findings of the SR1.5, the current format creates the impression that there is no difference between a 1.5C and 2C-world, which is clearly not the case especially for the Cryosphere, long term Sea-Level-Rise and vulnerable Ocean-Ecosystems. We consider this a major shortcoming of the report which we had already pointed out during the SOD review, and would kindly ask the authors to address this important issue diligently. [Government of Germany]
4664	SPM	0	0	0	0	Post-2100 Sea Level Rise: The representation of post-2100 sea-level rise needs to be strengthened across the SPM, in particular through inclusion in existing figures or drafting of a specific new one (cf our comments to Figure SPM.1). It is unfortunate that the underlying report merely touches upon literature, including SR1.5, discussing the long-term sea-level commitment that is inherent in different emission pathways and policy goals, including current NDCs and overshoot pathways to 1.5C/2C and beyond. It is very clear - and also stated in ES of Chapter 4 - that GHG emissions in the 21st century can cause multi-meter sea level rise beyond 2100, with only a small fraction of this rise visible in 2100. Therefore, the year-2100 sea level rise is not an adequate measure to inform policymakers about the risks of various warming levels/emissions pathways, or effective adaptation choices. This major shortcoming of the report needs to be alleviated by a) including a graphic based on Figure 4.2 that depicts long term SLR, b) clear and prominent statements on the potential magnitude of long-term SLR, and the amount of SLR which can be avoided by following a low-emissions pathway, c) clear reference to the adaptation benefit of lower rates of SLR under low-emission scenarios. Again, care must be taken in portraying uncertainty: while rate and magnitude of long-term SLR may be uncertain, the long-term upward trend and its dependence on emission pathways is not. [Government of Germany]
4666	SPM	0	0	0	0	Treatment of mean sea level rise, extreme sea levels and adaptation across sections B and C: A lot of clarity could be gained if current section B3 was split in two standalone sections, with one (B3A) focusing on GMSL-rise, giving appropriate room to the change in assessment from AR5, the additional contribution from Antarctica, including the risk of irreversible loss of the WAIS/threshold behaviour, Greenland Ice-Sheet dynamics and post 2100 expected SLR. New B3B should then focus on extreme sea levels, elaborating on the analysis currently displayed in figure SPM.4 and providing a link to section C3 and B9, without duplication. Currently, similar content is given in B9, B9.1 and B3. We'd suggest to make current p15 ln 15-17 part of the new section B3B dealing with extreme water levels and risks of flooding together with B3.2 and B3.3, adding substance to B3.3B based on the information contained in Figure SPM.4 and underlying sections. Current B9 needs to be reconciled with current section C3 and Figure SPM.5. At the moment, there is significant overlap and the coastal/SLR-discussion in B stands out from all other topics by its emphasis on risks in the absence of adaptation. We would assume that for mountain regions, Arctic and fishery communities etc., the risk statements also mostly refer to a state without adaptation, but it is not repeatedly said. This should be aligned across sections, with substantive adaptation discussions either moved to section C across the board, or included for all sectors in B. For readability, brevity and consistency, our preference would be to focus on adaptation in C. Authors may also consider to use the term "increased exposure" instead of "increased risk" in order to describe what happens in the absence of adaptation, without discussing adaptation (cf. our comment to p15 ln 16). [Government of Germany]
4668	SPM	0	0	0	0	Acceleration of Climate Change and its impacts in observations: In the underlying report, a lot of evidence is given for accelerating processes in the last decades, e.g. SLR, glacial melt, Ice Sheet mass loss, permafrost warming, shifts in distribution of species etc. - however in the SPM, acceleration of observed changes is only mentioned twice for SLR in A3, and not displayed in the Figures. If observations show accelerating rates of change across many systems, that may be a core message that could be emphasized more across section A, in headlines statements and in the visuals. [Government of Germany]

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4670	SPM	0	0	0	0	Observed impacts and drivers: When revising Section A, each statement should be carefully checked for consistency and evidence supporting a clear causal chain to climate change or climate change impacts. The draft SPM is much more clear now about the relationships between cause and effect for observed impacts across Section A. We welcome the inclusion of effects that stem from multiple drivers, however there are still some issue regarding clarity of language with phrasing such as "…with impacts on…" (A4.1), "-…with consequences for…" (A5), "…effects …impacts …" (A5.2), where the second part of the statement could either be a generic assertion based on process knowledge or an attribution finding. E.g. for A5, it is clear that the geographical shifts have occurred and been observed since the 1950s, and attributed to warming, but it is less clear whether the consequences have also occurred and been observed and clearly attributed to those shifts in the literature, or whether the consequences are expected to show but have not been formally observed and attributed. Similar problems with wording arise in the subsections dealing with impacts on people. Please make sure the language is as concise as possible. [Government of Germany]
4672	SPM	0	0	0	0	Permafrost Feedback: The current treatment of permafrost in the SPM has much improved from the last draft. However it is still very fragmented, and does not do justice to the fact that permafrost thaw is one of the most important (and uncertain) feedback processes that may already be triggered with small temperature rise (or temporary overshoot), but much more likely under higher emission scenarios, supporting the case for stringent mitigation. We would like to see a statement on permafrost feedback incorporated into the headline statements, possibly within a new section on mitigation in C, or as an addition to B1 . It would be very helpful if the estimate of the magnitude of potential carbon loss from permafrost provided in B1.3 could be differentiated for different RCPs, and set into perspective with the recent estimate provided by the IPCC SR1,5. SR1.5 indicates up to 100 Gt CO2 uncertainty in the 2100 carbon budget for 1,5C (RCP 1.9) coming from permafrost and wetland feedbacks (cf. IPCC SR1,5 Chapter 2.2.2.2, p 107 and Annex to chapter 2). Given that many governments will recall the recent estimates from SR1,5, it would be helpful to build on that assessment, update or reference it here for consistency and transparency. Similarly, we'd urge the authors to maintain consistency with the SRCCL findings, e.g. SPMA3.2 "[…] Projected thawing of permafrost is expected to increase the loss of soil carbon (high confidence). During the 21st century, vegetation growth in those areas may compensate in part for this loss (low confidence)." Please see also our detailed comments on B1, A1.4 and B1.3. [Government of Germany]
4674	SPM	0	0	0	0	General Narrative: The SPM would benefit from a more clear-cut framing and narrative that highlights the main characteristics of the Ocean and Cryosphere for policymakers who may not be familiar with them. From our perspective, the following 5 issues are most relevant: 1) O&Cr are the climate system elements with the most profound inertia in their reaction to rising temperature. Consequently, many impacts of past and current emissions are delayed but unavoidable and partly irreversible, which in turn means that emissions today lock in CC effects on O&Cr for decades to millennia to come. A long-term perspective beyond 2100 is crucial to determine risk in O&Cr systems; uncertainty about the exact timing and magnitude of the effects should not be misunderstood as uncertainty about whether or not these effects will occur 2) O&Cr harbour the majority of the systems most sensitive to rising temperatures (and sinking pH): Arctic, Tropical Coral Reefs, High Mountains and low-lying islands and coasts are already affected and will be hard hit even with T-rise well below 2C, including potential impacts on economies (fisheries), food security and the loss of habitable land; O&Cr are therefore central to calibrate risk of future emissions and underscore the importance but also limitations of adaptation; 3) The majority of the large-scale climate feedbacks and discontinuities or tipping points identified in the Earth Systems form part of the O&Cr, e.g. permafrost thaw, disintegration of the Antarctic or Greenland Ice Shields, AMOC slowdown, marine C-pump etc.; due to the massive risk tied to these processes, they must be monitored closely and mitigation policies need to be designed to limit the probability of crossing such thresholds; 4) the Ocean is of utmost importance for the climate system, e.g. as a heat and carbon sink, and at the same time marine ecosystems are highly sensitive to temperature and pH/O2 change; we are witnessing the emergence of a totally new Ocean climate, putting many important (ecosystem) services to humanity, including food provision, at risk; the dimension of change in the Ocean needs to be better understood by policy makers 5) Oceans, High Mountain Areas and the Poles present specific governance challenges within and beyond national jurisdictions. Given ongoing drastic changes, measures to manage risk and increase resilience need to be taken at all levels of society and government, and international cooperation strengthened. [Government of Germany]

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4676	SPM	0	0	0	0	Confidence levels and consistency: Findings presented in the SPM and the levels of confidence with which they are presented need to be consistent with the underlying report, and also within the SPM across sections. We found several instances where formulations in the SPM deviate from the wording in the underlying chapter, where confidence levels are not consistent or traceable (cf comments on Arctic Sea Ice - A2.4 and A8.3, NPP and nutrient change - A2.5, SPM.3). We would like to encourage the authors to very closely scrutinize the SPM to avoid errors and inconsistencies, also in the light of consistent treatment of uncertainties between this report and other products of the AR6-cycle. It is our impression that at some instances, likelihood statements from chapter ES have been transformed into confidence statements in the SPM, following the guidance of Ch1-42, Figure 1-4, but not always in a consistent manner. Also, the level of precision of the statement and the level of confidence need to be balanced; a very generic statement or a very broad range may not be very informative, even with high confidence. [Government of Germany]
4678	SPM	0	0	0	0	Blue Carbon - marine carbon management: There is currently little emphasis in the SPM on the role of the Ocean and coastal ecosystems as a carbon sink. Apart from a cursory mentioning of the rate of carbon uptake in mangroves in A6.1 and well-managed coastal blue carbon ecosystems in C2.5, the potential of actively managing coastal ecosystem for protection of existing carbon stocks/enhanced uptake of CO2 are not considered. To provide a more solution-oriented outlook, we'd suggest to include a short appraisal of these options in the new mitigation section in C (cf our comment "Mitigation"), and potentially also refer to marine carbon management in the open ocean, as in 5.5.1.2.5. "Because of the many technical, environmental and governance issues relating to marine productivity enhancement, by either direct fertilization or upwelling, there is low confidence that such open ocean manipulations provide a viable mitigation measure." [Government of Germany]
4680	SPM	0	0	0	0	Section 5.2.2 is frequently given as a reference across all sections of the report. However 5.2.2 is 27 pages long and this makes it difficult to trace the findings in the underlying report. Please refer to subsections of 5.2.2 to provide a clear traceable account for findings based on section 5.2.2. [Government of Germany]
4682	SPM	0	0	0	0	We would like to highlight that the new icons support the comprehensible structure of the SPM, which probably will help policy-makers to find their aspects easily. Though, it should be carefully checked (again) whether the icons are set correctly, e.g. C2.1 should also carry the "ocean" icon since protected areas at sea are named and important to the whole message. [Government of Germany]
4684	SPM	0	0	0	0	The whole text should be reviewed and carefully scrutinized to increase readability and accessibility for policy-makers. Often the practical relevance is too well hidden behind or within the scientifically correct statement. Several sentences incorporate (too) many numbers which may discourage readers and weaken the meaning (e.g. A2.1). Some sentences show challenging length, but may be easily cut down by separating aspects or shorten the statement. Please check also whether some findings may be consolidated into one statement to reduce text and avoid repetitions. [Government of Germany]
4686	SPM	0	0	0	0	Generally, the text is understandable, but its strong fragmentation makes it difficult to grasp the overall messages. The introductory summaries at the beginning of the sub-chapters of the TS of Chapter 5 are more reader-friendly and clearer than the SPM. Please consider to provide similar overarching statements in the SPM, or revise language of headline statements correspondingly. [Government of Germany]
4688	SPM	0	0	0	0	All SPM Figures are too complex and try to transport too much information. The reader needs much time to comprehend the coding of information and assess the messages. They should be improved by selecting the most valuable information, focusing on a clear visual presentation and remove the rest, keeping important content in the text. [Government of Germany]
4692	SPM	0	0	0	0	Please consider to change the icon for ocean: Coral reefs are primarily associated with the coastal zone. Maybe just a wave; wave and a fish. Also, it may be helpful to separate coastal ecosystems from SLR and coasts - we are aware that the icons follow the chapter structure, however if they are to provide added value beyond the referenced sections, it may be helpful to make this distinction. Please consider to also add an icon representing extreme events. [Government of Germany]
4694	SPM	0	0	0	0	In the whole SPM (and previous ARs) there seems to be an underrepresentation of "low probability - high impact" outcomes, which may stem from the way of using the calibrated IPCC language. Our impression is that statements on such events, although formally correct, can be misleading from a policy and risk perspective. E.g. an event that is reported as "unlikely" may be perceived as almost hypothetical, while its probability could be up to 10%. However, is e.g. a 10% risk of the collapse of the AMOC or a 5% risk of substantially higher, faster and irreversible SLR due to "deeply uncertain" ice-sheet processes an acceptable risk? Would a different way of phrasing this lead to different decisions? While we support the deletion of the complex concept of "deep uncertainty" from the SPM, we'd still suggest that the authors consider a precautionary approach when choosing how to present information on "low probability - high impact" outcomes. [Government of Germany]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
4696	SPM	0	0	0	0	Contextualize and reduce quantitative technical information: In many occasions the SPM provides quantitative information without putting it into context. For a summary for policymakers, detailed technical information is often not needed to convey the central finding, and may be more confusing than helpful. Therefore please consider carefully whether exact numbers and ranges are relevant in the context of the SPM. For those instances where technical detail is provided, it is however necessary to help the reader with additional information, e.g. totals, fractions, trends (and familiar units) whenever possible to facilitate understanding the dimension and significance of change. One example is the information on ocean acidification in para A2.6: "Open ocean surface pH has declined by a very likely range of 0.017 to 0.027 pH units per decade since the late 1980s." The information on the acidification rate in the SROCC is only useful, if its change / acceleration is highlighted. The AR5 SYR reads in Section 1.1.2 "Since the beginning of the industrial era, oceanic uptake of CO2 has resulted in acidification of the ocean; the pH of ocean surface water has decreased by 0.1 (high confidence), corresponding to a 26% increase in acidity, measured as hydrogen ion concentration." While adding to length, the supplementary information on the acidity is enhancing understanding. We would recommend similar wording to put such numbers into perspective. More specific comments are provided on the respective text passages. [Government of Germany]
4698	SPM	0	0	0	0	What is a "very likely range"? Does this refer to the 5-95 range? Please do not introduce new language. In addition, it is expressed differently (x to y or x - y or x+/-d). As this is the SPM, please try to be as clear and consistent as possible. [Government of Germany]
4700	SPM	0	0	0	0	Please add "Risk Reduction through Mitigation" Section in C - "options": Mitigation is hardly directly addressed in the SPM, and if so, then in conjunction with adaption, e.g. in C5.2. While it is clear that the scope of the report does not provide material for an extensive discussion of mitigation options, more emphasis should be put on risk reduction through mitigation, which is currently missing from section C "options". The findings of the underlying report and the SR1.5 clearly show very high risks even at modest levels of additional global warming, e.g. from SLR, glacial and Ice-Sheet melt or permafrost thaw, in particular beyond 2100. Such non-linear and mostly irreversible long term changes resulting from actions today carry very high risk and may lead to limits of adaptive capacity. The only way to prevent these high risks in the long run is stringent mitigation action, a message that the SROCC should convey more clearly than it currently does. We'd therefore recommend to strengthen findings on risk reduction through mitigation throughout the SPM, and include a standalone section on risk reduction through mitigation in section C, which is currently mostly focused on adaptation. This section could also highlight non-linear processes that can only be safely avoided through mitigation (e.g. permafrost thaw, WAIS disintegration, AMOC:…), and emphasize committed impacts and long-term change from near-term emissions, including overshoot pathways. [Government of Germany]
4702	SPM	0	0	0	0	Harmful Algal Blooms: WGII AR5 concluded that harmful algal outbreaks had increased in frequency and intensity, caused partly by warming, nutrient fluctuations in upwelling areas, and coastal eutrophication (medium confidence) (Box 5.4). This report presents new and additional evidence that "shifts in biogeography, increased abundance and increased toxicity of HABs in recent years have been partly or wholly caused by warming and by other, more direct human drivers." (Box 5.4). Given the current prevalence of harmful algal blooms at many of the world's shores, especially in tropical and Mediterranean climates, we would strongly support a more prominent inclusion of HABs, their risks to people and possible prevention measures (based on Box 5.4 and sections 5.4.2 and 5.5.2) in the SPM, e.g. by inserting the following lines in the headline statement A8 on p11 ln 47 ",… led to increase in harmful algal blooms and to observed impacts on fisheries (high confidence)", and by lifting relevant material from Chapter 5 to the SPM, e.g. in sections B6, headline of B8 and C2 (as an example for mitigating other pressures to improve ecosystem resilience and functionality). On a side note, while we understand the emphasis on consequences of HAB for people, it is a little odd not to reference algal blooms in the section on ecosystem change. If this could be fixed, maybe through a short reference in A6 and B6, it would help avoid confusion. [Government of Germany]
4704	SPM	0	0	0	0	Length and readability: Despite featuring 6 instead of 5 figures, the first order draft of the SPM was 7 pages shorter than the current version, and a lot closer to the format actually envisaged for the SPM (~15 DIN A4 pages). The current SPM provides a robust summary of key findings, however it is still too long, has many convoluted sentences and uses too much technical language. We'd strongly urge the authors to work toward overall length reduction during the next revision, also in the light of the relatively short approval session at IPCC-51. [Government of Germany]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
4706	SPM	0	0	0	0	Permafrost processes and abrupt thaw: B4.3 suggests that the permafrost area will see a landscape-scale transformation, however this is notincluded in the headline statement B4. New literature supports earlier reports of the onset of drastic changes in many Arctic/Tundra landscapes, more frequent disturbances and abrupt thaw dynamics (e.g. DOI: 10.1038/s41467-018-05738-9, 10.1038/d41586-019-01313-4 https://www.nature.com/articles/s41467-018-07663-3;). We would have expected a more extensive discussion of these observations and potential consequences, including abrupt permafrost thaw processes and their current and future impacts on ecosystems, hydrology, and landscapes in the SROCC. There is extensive discussion of some processes in Chapter 2, and a rather short but still substantive discussion in Chapter 3, however the SPM, and in particular the headline statements, only deliver very general messages on permafrost. We'd appreciate a reference to the observed disturbance regimes and acceleration of abrupt thaw processes in A1.4. The lack of representation of these processes in CMIP5 - generation models should be addressed, e.g. in A1.4, or B1.3 (cf. CC Box 5), in order to provide context to findings on Permafrost. As for other tipping elements, we would prefer comprehensive information with indication of uncertainty in a standalone section. As is, information on Permafrost is scattered across the SPM and no clear summary is provided. That makes it very difficult to draw conclusions. [Government of Germany]
4708	SPM	0	0	0	0	We would suggest to rephrase the discussion around long-term SLR and risk from IS-instabilities in a way that focuses on what we know instead of the uncertainties. In our view, the main line of argument should be "CO2-emissions over the 21st century will have massive consequences for the forthcoming centuries. Instabilities of Ice-Shields are becoming more likely with rising global temperatures. Lower emissions also mean lower risk of irreversible sea level rise". Mitigation is the only way to reduce this risk. That should become more clear, also in Section C. [Government of Germany]
4710	SPM	0	0	0	0	Consistency of findings across SRs: SROCC will be approved and published less than a year after SR1.5, and just about 2 months after the SRCCL. We strongly recommend for the authors to revisit both SR1.5 and SRCCL and make sure that the assessments of the three reports are consistent, both for general outcomes and for levels of confidence. This is particularly important for issues that are being assessed in two or all of the reports at varying depths or level of detail, e.g. permafrost or SLR. If there has been new literature leading to a reassessment of the findings of SR1.5 or SRCCL, it should be stated explicitly with a reference to the discussion in the underlying SROCC chapter. Otherwise, contradictions, conflicting statements, or deviating levels of confidence should be avoided, as they would hurt the integrity of the IPCC and the credibility of both the scientific community and the IPCC process. Please make sure that there are no unintentional reassessments of SRCCL/SR1.5 findings in the SROCC SPM. [Government of Germany]
4712	SPM	0	0	0	0	Consistent use of concepts between SRs: The three IPCC Special Reports provided since the beginning of the sixth assessment cycle are very different in their choice of scenarios considered (e.g. RCPs, SSPs, overshoot) and approaches and concepts (e.g. risk assessment for temperature differentials (SR1.5) vs. high-low emission scenarios, suggested variations of "reasons for concern" for different SSPs or with and without adaptation, for area (SRCCL) or SLR (SROCC); consideration of committed emissions from NDCs). For example, the SRCCL places much emphasis on different socio-economic futures under the SSP-framework, while SROCC doesn't use this framing. SR1.5 provided differential impact assessments and referred to emission pathways consistent with existing policies, while SROCC reverts to a "RCP2.6 vs RCP8.5" framing without considering RCP1.9, or a trajectory consistent with current policies. This variety poses a challenge to the audience, which is the same for the subsequent reports. Please provide guidance to the reader regarding the choice of and rationale for different approaches and framings between this report and the SR1.5, SRCCL, and AR5. [Government of Germany]
4736	SPM	0	0	0	0	Figure SPM.1: for improved traceability of the headlines A1, …, B1, … the reference to figure SPM.1 should be specified as follows {… Figure SPM.1 a, …,}, indicating the panel that is being referred to. [Government of Germany]
6092	SPM	0	0	0	0	The following priority topic areas arose from technical review of the second-order draft SPM: - Need to streamline content and improve accessibility [STRUCTURE] - Dense text and convoluted language [JARGON] - Skewed or diluted confidence intervals due to conflated material [CONFIDENCE] - Metrics and thresholds for extreme events [EXTREMES] Details regarding these concerns are provided in the whole document and line-by-line comments, flagged for ease of reference. Cells in the body of this table labeled 'KEY ISSUE' with an accompanying tag in brackets indicate specific comments/suggestions that tie back to these broad themes. There is no implied priority order. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6094	SPM	0	0	0	0	In light of references to the Paris Agreement in the SPM, it is worth reiterating that the United States intends to withdraw from the Paris Agreement at the earliest opportunity absent the identification of terms that are more favorable to the American people. The comments provided on this report are expert comments on scientific and technical issues. They do not reflect any statement on or change in the U.S. position with respect to the Paris Agreement or climate change policy or represent any implied commitment. [Government of United States of America]
6096	SPM	0	0	0	0	These comments reflect the input of individual U.S. Government expert reviewers and, as such, do not necessarily reflect official statements of U.S. climate policy. [Government of United States of America]
6098	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: Future Special Reports would benefit from adopting a more focused and congruent set of topical areas. The current report suffers from a forced attempt to merge largely disparate topics of cryosphere and oceans. As a result, the document proves a very difficult read and, because each of these fields alone could easily and more cogently be devoted to a stand-alone report, results in an SPM that lacks focus with each topic competing for the attention each are due. At this time, the best approach would be to ensure that both the SPM and supporting document adopt a more balanced and uniform treatment of the two topical areas. In the case of the SPM itself, the sheer number of key findings should be significantly condensed (i.e., by half) to only the broadest and most purposeful statements. They should include only those of greatest import with the most critical of these advanced to the front of the document. As is, the level of granularity drastically varies from global generalities to anecdotal, highly localized phenomena. It's recommend the SPM favor the former versus the latter. More concerning, as a consequence of what reads as ad hoc consolidation of findings, some messages are conflated and/or their assigned confidence misleading. [Government of United States of America]
6100	SPM	0	0	0	0	KEY ISSUE [JARGON]: Many sections of the document contain stilted scientific language that will make it hard to read and inaccessible for some policymakers, which include non-scientists and non-native English speakers. SPM figures and captions are generally difficult to read and interpret. Some of the sentence structures in the SPM are convoluted and therefore make the conveyed information unnecessarily difficult to follow. Simplifying sentences that continue for several lines will enhance readability. Using terms like 'mass-loss', 'standing stock', 'Meridional overturning circulation', 'foundation species', 'biotic community structure', 'resolute migration', etc., distracts the reader from clearly understanding the key messages. Suggest that a skilled science communicator work closely with the SPM authors to review every statement, figure, and caption for readability and edit as needed. This type of editing is not necessary for the Technical Summary or the underlying chapters, but it is essential for the Summary for Policymakers. [Government of United States of America]
6102	SPM	0	0	0	0	KEY ISSUE [CONFIDENCE]: Often, the confidence and likelihood statements attached to key points are too low. Authors often mix statements about the Arctic and high mountain areas that should have different levels of confidence assigned. It appears that authors have done some sort of qualitative averaging to come up with a single, (mostly) reasonable confidence level for both regions combined, but this can also be confusing. It is recommend that the confidence and likelihood statements be revised to provide separate confidence and likelihood statements for the Arctic and alpine regions. [Government of United States of America]
6104	SPM	0	0	0	0	KEY ISSUE [EXTREMES]: What is 'extreme' in one location may not be for another and in all cases. Extreme sea levels do not necessarily convey to flooding of societal assets/infrastructure with impacts. Assessments using flood height thresholds -- like those of NOAA for minor, moderate, or major flooding -- do support such statements. The authors need to either provide the height of the 100-year probability (referenced to a high water reference for regional/global comparison) and/or use height thresholds that are location- or regionally specific, instead of making global generalizations. Also, if statements are provided that use the term 'flooding' it needs to be qualified by 'referenced to today's infrastructure heights'. Also, when discussing changes in extreme sea level event probabilities, authors need to clarify if relative/local sea level rise projections are being used. [Government of United States of America]
6106	SPM	0	0	0	0	Several figures are too complex and try to synthesize too much information from too many disparate sources. See in particular U.S. comments on Figure SPM.2 and SPM.5. Authors need to determine if inclusion genuinely adds value to the discourse. If graphics do not contribute to flow of document, consider deletion. [Government of United States of America]
6108	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: The utility of the symbols for themes (i.e., mountain cryosphere, polar regions, sea level rise/coasts, and oceans) is uncertain. The categories and symbols may confuse readers (e.g., the symbol for sea level rise/coasts could be interpreted as human settlements) and could make approval of the SPM more difficult. An alternative could be to restructure sections A and B of the SPM around these and/or other themes, devoting a section to each that covers observed changes and impacts as well as projected changes and impacts. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6110	SPM	0	0	0	0	The SPM contains several inaccuracies in the discussion of wetlands, corals, seagrasses and low-lying coastal areas. Section A6.4 is the most problematic. Line 17 (page 9) states that "marshes and mangroves have generally kept up with fast rates of sea level rise (e.g., >10 mm year-1)". This is simply not true. Coastal vegetated wetlands and barrier shorelines were rapidly transgressed and submerged during "fast" rates of sea level rise during the Holocene and before. Low-lying coasts typically submerged and shorelines migrated inland during meltwater events of the past several million years. The sign on line 17 before 10 mm should be "less than" ('<') not "more than", and the words "fast rates" should be "slow rates". Also, it is dangerous to state that coastal wetlands will or will not keep pace with any given rate of sea level rise, because it depends on whether or not the wetlands can accrete vertically or migrate inland. (Corrections also need to be made in Chapter 4.) Some wetlands cannot keep pace with sea level rise under low emission scenarios. Refer to GEOPHYSICAL RESEARCH LETTERS, VOL. 37, L23401, doi:10.1029/2010GL045489, 2010, Limits on the adaptability of coastal marshes to sea level. Here is an excerpt: "These results suggest that expansive marshes in regions with low tidal ranges or sediment concentrations will likely submerge in the near future, even for conservative projections of SLR. For example, our models predict a threshold SLR rate of about 5 mm/yr for marshes in the Plum Island Estuary, the largest estuary in New England (Massachusetts, USA: SSC = 3 mg/L, TR = 3 m (C. Hopkinson, Dissolved nutrient and particulate concentrations of freshwater inputs to the Plum Island estuarine system, taken approximately monthly, Plum Island Ecosystem LTER Database, 2007, available at http://ecosystems.mbl.edu/PIE/data/WAT/WATVA-Inputs.html)), and for marshes in the Albemarle-Pamlico Sound, the second largest estuary in the United States (North Carolina, USA: SSC = 10 mg/L, TR = 0.5 m [Lunetta et al., 2009])." There are many other references with this same type of conclusion about low thresholds of submergence in some coastal systems. [Government of United States of America]
6112	SPM	0	0	0	0	With respect to some of the permafrost, coastal, and alpine statements, be sure they are in agreement with the IPCC Land Special Report (SRCCL). [Government of United States of America]
6114	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: Document would benefit from a bit clearer organization and stronger connection of text and figures so the reader can find and relate information more effectively. [Government of United States of America]
6116	SPM	0	0	0	0	The information in the document does not seem to be balanced regionally (e.g., A2 observed physical changes section has Arctic/North Atlantic emphasis). [Government of United States of America]
6118	SPM	0	0	0	0	Open ocean vs. coastal: Need to clearly delineate what changes refer to both, and what is unique to each system. [Government of United States of America]
6120	SPM	0	0	0	0	Sea level seems to be the dominant aspect. Why are there no figures showing other changes -- e.g., global heat waves distribution or global seagrass/coral decline? [Government of United States of America]
6122	SPM	0	0	0	0	The language on alpine areas and mountain regions is in line with the scientific literature and the confidence levels assigned are appropriate, with exceptions noted in line-by-line comments. [Government of United States of America]
6124	SPM	0	0	0	0	Language throughout tends to imply that all of the Arctic is acting the same. [Government of United States of America]
6126	SPM	0	0	0	0	Authors mix Arctic and alpine in ways that make the take home points unclear. [Government of United States of America]
6128	SPM	0	0	0	0	KEY ISSUE [CONFIDENCE]: Authors often mix statements about the Arctic and high mountain areas that should have different levels of confidence assigned. Generally speaking, confidence tends to be higher in the Arctic for most impacts discussed, whereas there is less certainty in mountain areas. [Government of United States of America]
6130	SPM	0	0	0	0	KEY ISSUE [JARGON]: A lot of this document is written in really stilted scientific language that is hard to read. For example, phrases like "Ranges of seagrass meadows and kelp forests are contracting at low latitudes attributed to warming since the late 1970s" could be recast more simply into "Warming since the late 1970s has caused ranges of seagrass meadows and kelp forests in low latitudes to contract." Will the editorial team go through the document and edit simply for readability without sacrificing scientific accuracy? There is a huge need to state things in this SPM simply and straightforwardly. Readers are not scientific audiences who are accustomed to wading through thickets of passive verbs and awkward adjectival phrases. [Government of United States of America]
6132	SPM	0	0	0	0	KEY ISSUE [CONFIDENCE]: The use of likelihood and confidence statements is really uneven, which could cause readers to step away from the document with an incomplete and possibly inaccurate understanding of the current state of knowledge. Strive for consistent use document-wide. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6134	SPM	0	0	0	0	KEY ISSUE [JARGON]: The writing is too dense for policymakers and in many paragraphs there are more numbers than text. Not sure how a non-scientist will be be able to wade through all the quantitative facts and be able to appreciate the problems. It seems that in an effort to summarize a huge amount of data, sentences run on with somewhat unrelated concepts being grouped together. There is also a lot of repetition of the issues. [Government of United States of America]
6136	SPM	0	0	0	0	KEY ISSUE [JARGON]: There is lots of great information in here, and it is clear the authors did a substantial amount of work. HOWEVER, the language is often too technical, particularly in the 'Key Findings' summaries (yellow boxes). Who is the intended audience? If it is policymakers, and includes non-native english speakers who likely are not scientists, many of the messages are going to be lost. [Government of United States of America]
6138	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: There are too many 'Key Findings': 23 (yellow boxes) spread across three sections (observed, projected, responses). These will be the focus for many readers. This number should be cut down substantially, to about 12. There are many good opportunities to combine and it seems like they would carry more weight if they were not separated across the three sections. Currently the reader sees 18 messages of doom-and-gloom (observations and projections) before getting to the 5 messages of hope (response). It would be better to combine messages into a format of ISSUE-OUTLOOK-SOLUTION (observed-projected-response) so that each message outlines the problem, where the world is headed if nothing done about it, and end with a bit of a positive notion of HOW decisionmakers can do something about it. Key Finding B9 is close to a good example. Combine it with A3 and C3 and cut the wordiness. Similarly, could combine A2+B2+C3 (portions); A5+B5+B8+C4 (partial); A6+B6+B8+C2+C3. [Government of United States of America]
6140	SPM	0	0	0	0	Include rationale/explanation for why certain observation years are included/described -- e.g., 2006-2015 for ice sheets and glaciers and 1967-2018 for snow cover extent on page SPM-3. [Government of United States of America]
6142	SPM	0	0	0	0	When describing net changes that are anticipated to occur by the end of the century, include a reference period for each value (i.e., decline 10% relative to pre-industrial or 1900 values). [Government of United States of America]
6144	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: The entire SPM is carefully formulated, but there is a communications problem. This summary continues the standard IPCC dry bureaucratic style, which is good for presenting evidence but not for getting across urgency. The highlighted lines 9-12 on page 28 summarize the SPM. Move it to the front. [Government of United States of America]
6146	SPM	0	0	0	0	On the ordering of the key messages, is there a reason that the Southern Ocean is emphasized as the first message? It is not clear why this is the most important point. [Government of United States of America]
6148	SPM	0	0	0	0	It appears as if the authors' conservative approach gives RCP2.6 top billing as the most likely outcome. It is often explained first and gets at least equal space if not more than RCP8.5 in the vast majority of key messages; RCP4.5 is never even mentioned. This is not an accurate representation of the scientific consensus. Buried text saying that the world is not on that path does not compensate for this overall tone. If it is going to be described as a realistic bound for the range of options, it is acceptable to refer to it after 8.5 (e.g., B2.3) and simply as having less effect, as in B5.1 or B2.7. But presenting it consistently as the first option is not realistic. The most relevant numbers should be presented first. [Government of United States of America]
6150	SPM	0	0	0	0	"Managed retreat" is not always feasible, and potentially incompatible with cultural identity and continuity. The term "vexing challenges" has been used in this document, and this is one of them. This point should be reinforced as needed throughout the SPM. [Government of United States of America]
6152	SPM	0	0	0	0	The SPM lacks reference to potential impacts on fisheries components of island nations GDP. [Government of United States of America]
6154	SPM	0	0	0	0	The author team should significantly revise the language of this SPM to be in line with the IPCC's scientific assessment role. Too often, projections of future changes and impacts are presented as inevitable or factual. While these changes may have broad scientific support and simpler language may be judged as an effective communication practice by some, the IPCC must base its statements solely on what can be scientifically justified. Authors are urged to point to the scientific basis for all predictions of future changes and impacts. This will include replacing statements that "XXX will occur in coming decades" to "modeled projections indicate that XXX will likely occur in coming decades" or "based on recent observed changes in other regions, XXX will more likely than not occur in coming decades" etc. [Government of United States of America]
6156	SPM	0	0	0	0	Many statements in the SPM, particularly in Section C, come close, and in some cases cross over the line to policy-prescriptiveness. For example, the circular logic of the headline statement of C5 should be avoided. The statement reads that to enable climate resilient and sustainable development depends critically on urgent … implementation of … adaptation actions." This is hardly a noteworthy finding, and makes the appearance that the IPCC is advocating a particular set of policies. The IPCC should present the benefits [and costs] associated with the implementation of low emissions and climate resilient pathways based on the findings within the scientific literature. The reader should be able to interpret and justify whether such actions are "critical" or "required." [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6158	SPM	0	0	0	0	The SPM uses normative terms like "just" and "equitable" without appropriate caveats to denote the lack of common understanding on the application of these terms or what objective criteria is being used by the IPCC in the usage of these terms. What is considered just or equitable by some may not be the same as what others consider just or equitable. The IPCC should not be the place where these concepts are adjudicated. The authors should even consider their use of "sustainable" in places, as there are a diversity of perspectives on this term as it may apply to climate -- or more broadly environmental -- policy. The IPCC must be careful to remain neutral and not to endorse a particular view on these topics. In the majority of cases, suggest removing references to normative terms throughout the SPM. [Government of United States of America]
6160	SPM	0	0	0	0	KEY ISSUE [JARGON]: The term "adaptation limits" appears to be loosely used throughout the SPM to refer to the ability of systems to respond to potential changes in climate. First, while there are limits to some adaptation approaches, there are often further transformational approaches that can be taken to overcome limits. The SPM should be revised to include statements on transformative approaches to adaptation consistent with AR5 findings. Second, there is no discussion of the role of innovation, technological growth, or improvements in the ability of governments, communities, and households to implement adaptation approaches within this discussion of so-called adaptation limits. The scientific literature on mitigation, and recent IPCC reports, assume that unprecedented actions on mitigation could occur to limit warming to very low levels, yet in the adaptation literature, often the most costly and conservative assumptions are used to describe our ability to respond to climatic change. If these issues are not well treated in the relevant scientific literature, the IPCC should note this knowledge gap within any discussion of future adaptation limits. Even on the ecological side, there could be future technologies which enable the increased resilience of species to climate change, like seed banking, genetic modification, or selective breeding. A broad assumption of adaptation limits and its use in the SPM should be reduced if not eliminated from the summary. Finally, where limits to adaptation are mentioned, the report should clearly indicate the source of the limitation, whether it be a product of the physical system, the ability to implement adaptation approaches, or based on perceptions of social, political, and economic constraints. For example, some may see the relocation of populations from low-lying areas as an effective adaptation strategy while others may see it as a failure of adaptation. To treat issues such as these objectively, the IPCC must not fall into a trap of discussing such issues with an overly broad term such as limits to adaptation. [Government of United States of America]
6162	SPM	0	0	0	0	The reference period for indicating impacts needs to match that for global warming used in negotiations and elsewhere in IPCC assessments -- namely the pre-industrial period. So, findings need to indicate how much change has occurred to date, then give the total amounts of change projected for the future and 2100. By just stating how much further change will occur, this greatly underplays how much change is being caused by human activities, and this is important because many aspects of society (e.g., how far above sea level cities are located, the vegetation landscape, construction on permafrosted lands, and more) are based on the pre-industrial (or at least early 20th century) conditions, and not somehow updated to the present. [Government of United States of America]
6164	SPM	0	0	0	0	Ending much of the discussion of projections at 2100 (glaciers, ice sheets, permafrost, sea level, etc.) fails to provide policymakers the real significance of changes already underway because many of these systems will be far from equilibrium and continue to have worsening impacts for the environment and society for centuries thereafter. This long time constant needs to be explained in a prominent way. [Government of United States of America]
6166	SPM	0	0	0	0	While helpful to be explaining the results of the RCP8.5 and RCP2.6 extremes, it is unfortunate that the SPM does not describe the consequences and significance of what seems the probable path of warming -- that is, overshooting 1.5 and 2°C (so going up to perhaps 2.5-3°C) then being brought back down by CO2 removal. Which of the effects and impacts on the environment are reversible and which are not? This is a really important issue to be considering with respect to glaciers, ice sheets, sea ice, snow cover, permafrost, oxygenation, acidification, marine life, etc. [Government of United States of America]
6168	SPM	0	0	0	0	It is unfortunate that the only scenarios being discussed are the quite low (RCP2.6) and quite high (RCP8.5) emission scenarios. Quite a number of statements that are included talking about "under RCP8.5" scenarios apply to virtually all of the scenarios in between, but this is not indicated by the wording. It would be more helpful to the reader to be giving indications of peak temperature reached and then indicating that keeping temperatures below 1.5 to 2°C involve getting to net-zero emissions by roughly mid-century or sooner and that going above this level of warming (so continuing net fossil fuel emissions beyond 2050) will lead to the types of consequence that are here associated with the higher emissions scenarios like RCP8.5 (and not just that scenario). [Government of United States of America]
6170	SPM	0	0	0	0	KEY ISSUE [STRUCTURE]: The organization of the SPM needs to be modified to get the most important messages for policymakers up front. They will read at most a few pages, and all the key findings need to be up front, with supporting information provided on the ensuing pages -- not building up one's case and putting the key findings toward the end of the text and the numbering system. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6172	SPM	0	0	0	0	Chapter 5 (page 5-4, section 5.2.2.6): Consider re-working the following: "In response to ocean warming and increased stratification, open ocean nutrient cycles are being perturbed and there is high confidence that this is having a regionally variable impact on primary producers. There is currently low confidence in appraising past open ocean productivity trends, including those determined by satellites, due to newly identified region-specific drivers of microbial growth and the lack of corroborating in situ time series data sets. {5.2.2.5, 5.2.2.6}" As written, it is technically correct, in that ocean productivity trends can have large uncertainties due to a variety of factors (including discrepancies between satellite algorithms, length of time-series, etc.), but the 'low confidence' of the satellite measurements can be misleading. Also 'drivers of microbial growth' as one of two things that cause 'low confidence' on NPP is misleading.There are many factors that can affect NPP. The text towards the middle and end of section 5.2.2.6 on the different drivers that impact NPP provides a better reasoning on why it's so difficult to come up with trends that have higher confidence. Suggest speaking about uncertainties in trends, rather than low confidence in them; the low uncertainty stems from differences in algorithms and sensors, and the fact that as time series increase in length, trends will change. The statement “Overall, there is low confidence in satellite-based trends in global ocean NPP due to the time series length and lack of corroborating in situ measurements or other validation time series. This is especially true at regional scales where distinct sets of poorly understood processes dominate” is overly simplistic and not totally accurate. Yes, the TS are short, and yes, there are not enough in situ TS to validate remote sensing data, but that’s not why there are uncertainties in the satellite trends. Longer TS and more in situ validation would make models and measurements better and reduce their uncertainty, but the intrinsic differences in sensors and algorithms will always exist. Also add in this section (especially when talking about “unambiguously isolate long term climate related trends from natural variability”) the Henson work – already citing her work elsewhere (e.g. Box 5.1 - this would be Henson et al. 2017). If authors wish and literature cutoff date allows, there is a recent paper published by Turk et al. 2019 (Frontiers in Marine Science) that talks about ToE in the North American continental margin. Suggest replacing the Rousseaux and Gregg reference of 2014 with their more recent work: Gregg, W. W., C. S. Rousseaux, and B. A. Franz. 2017. "Global trends in ocean phytoplankton: a new assessment using revised ocean colour data." Remote Sensing Letters 8 (12): 1102-1111 [10.1080/2150704x.2017.1354263]. [Government of United States of America]
6174	SPM	0	0	0	0	Chapter 6 (page 10, section 6.2.2): The fact that Africa and Pacific regions have had fewer attribution studies is irrelevant to the first, more important point of the sentence starting with "Collectively, these studies show that the role of climate change in the ocean and cryosphere extreme events is increasingly driving extreme climate and weather events across the globe including compound events (high confidence)." Suggest splitting into two sentences after "(high confidence)". State that more attribution studies should be conducted in Africa and Pacific regions because those regions have relatively less local/regional institutional resources. [Government of United States of America]
6176	SPM	0	0	0	0	Chapter 6 (page 22) states "Satellite observations from 1985 to 2018, showed small increases in significant wave height and larger increases (5%) in extreme wave heights (90th percentiles), especially in the Southern Ocean (Young and Ribal, 2019)". In fact, the Young and Ribal paper states "The regional distribution of trends for the 90th percentile wind speed shows statistically significant increases in most areas. In contrast, increases in 90th percentile waves are confined to the Southern and North Atlantic oceans." Thus, the Chapter 6 text misinterprets the paper's conclusions when it says "especially" because the increase in extreme waves (90th percentile) is found ONLY in the Southern and North Atlantic Oceans. [Government of United States of America]
6178	SPM	0	0	0	0	Chapter 6 (page 23, first continued paragraph regarding projected increase of significant wave height): Consider adding reference to the Arctic ocean because of decreasing sea ice extent (see section 6.3.1.3, page 22, paragraph 22, last sentence Holland 2006 reference). [Government of United States of America]
6180	SPM	0	0	0	0	Chapter 6 (page 4): After paragraph 5 ("An increase in the average intensity…"), add the following about the projection of Southern Hemisphere extra-cyclones: "The storm tracks for the Southern Hemisphere extra-cyclones are projected to have a continued strengthening and southward contraction (medium confidence). {6.3.1.2}" [Government of United States of America]
6182	SPM	0	0	0	0	Chapter 6 (page 4): In the second to last paragraph (""Extreme El Nino…""), add the following: ""Swings from extreme El Niño to extreme La Niña (opposite of extreme El Niño) have been projected to occur more frequently under greenhouse warming."" [Government of United States of America]
6184	SPM	0	0	0	0	Chapter 6 (page 4): After the second to last paragraph ("Extreme El Nino…"), add the following about Indian Ocean Dipole (IOD) events: "The frequency of extreme positive Indian Ocean Dipole (IOD) events are projected to increase from a one-in-seventeen-year event in the 20th century to a one-in-six-year event in the 21st century (low confidence). {6.5}" [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6186	SPM	0	0	0	0	Chapter 6 (page 5): In paragraph 8 ("Extreme change in the trade wind..."), add at the end the following about ITF projections: "On multidecadal and centennial timescales, it is likely that mean ITF decreases in response to greenhouse warming, due to reduction of net deep ocean upwelling in the tropical South Pacific." [Government of United States of America]
6188	SPM	0	0	0	0	Chapter 6 (page 5): In paragraph 9 ("By 2300, ..."), add at the end the following about the impact of including Greenland ice sheet melting on projections of AMOC strength and the SPG projection: "For instance, Greenland ice sheet melting could potentially add up to around 5-10% more AMOC weakening in 2100 under RCP8.5. There is low confidence in the projections of subpolar gyre fate due to poor representation of ocean deep convection. {6.7}" [Government of United States of America]
6190	SPM	0	0	0	0	Chapter 6 (page 3, paragraph 4): Add ""global and"" before ""regional"" since the increase in annual proportion of Category 4 or 5 tropical cyclones is a global change. original: ""There is emerging evidence for a number of regional changes in tropical cyclone behaviour such as an increase in annual global proportion of Category 4 or 5 tropical cyclones in recent decades, severe tropical cyclones occurring in the Arabian Sea and making landfall in East and Southeast Asia, increasing in frequency of moderately large US storm surge events since 1923 and the decreasing frequency of severe TCs making landfall in eastern Australia since the late 1800s, but low confidence that these represent detectable anthropogenic signals. {6.3}"" new: ""There is emerging evidence for a number of global and regional changes in tropical cyclone behaviour such as an increase in annual global proportion of Category 4 or 5 tropical cyclones in recent decades, severe tropical cyclones occurring in the Arabian Sea and making landfall in East and Southeast Asia, increasing in frequency of moderately large US storm surge events since 1923 and the decreasing frequency of severe TCs making landfall in eastern Australia since the late 1800s, but low confidence that these represent detectable anthropogenic signals. {6.3}"" [Government of United States of America]
6192	SPM	0	0	0	0	Chapter 6 (page 3, sentence starting with "satellite observations reveal that..."): Need to have a sentence (in bold font) summarizing how marine heatwaves changed. This paragraph talks only about changing characteristics of marine heatwaves, but not on how the changing heatwaves have negatively impacted marine organisms and ecosystems to support the first sentence of the paragraph." [Government of United States of America]
6194	SPM	0	0	0	0	Chapter 6 (page 3): The original sentence is a bit vague on defining ""extreme"" El Nino. Is pronounced rainfall in the normally dry equatorial east Pacific not common with El Nino? ""There have been three occurrences of extreme El Niño events during the modern observational period (1982-83, 1997-98, 2015-16), all characterised by pronounced rainfall in the normally dry equatorial east Pacific."" [Government of United States of America]
6196	SPM	0	0	0	0	Chapter 6 (page 25): Need cite(s) for "For example, projections by 2100 under the RCP8.5 scenario show a spatial variability along the coast of Chile with port operability loss between 600-ì800 h yr-1 and around 200 h yr-1 relative to present (1979-2005) conditions. Although wave changes are included in projected overtopping distributions, future changes of operability are mainly due to the sea level rise contribution." [Government of United States of America]
6198	SPM	0	0	0	0	Chapter 6 (page 28, Figure 6.3a): Text box indicates "Yellow Sea/ Sea of Japan" as a place with a recent MHW. However, only the Yellow Sea is colored. The Sea of Japan is either (a) below maximal intensity of 2°C or (b) incorrectly identified as the region wth the > 2°C maximal intensity to the east of China. [Government of United States of America]
6200	SPM	0	0	0	0	Chapter 6 (page 21, section 6.3.1.2): The first sentence is very awkward. Just say that ETCs are formed in mid-latitudes. [Government of United States of America]
6202	SPM	0	0	0	0	Chapter 6 (page 10, table item "ice-shelf collapses"): Verify exactly what is meant here. Is it "ice sheet collapse" or perhaps just "West-Antarctic Ice Sheet collapse"? [Government of United States of America]
7736	SPM	0	0	0	0	Policy-makers may want to use the most relevant figures displayed in the report in oral presentations on the report outcome. However, almost all the proposed figures from SPM.1 to SPM.5 are too complex to be displayed on a presentation slide or even in a policy report used by governments. Should the figures remain as they are, they will not be usable by policy-makers. Moreover, the risk of distorted interpretations or reworking of the figure will increase significantly if the figures are not sufficently clear. It is therefore suggested to review all figures in order to display less information on each of them and make them readily usable to policy-makers, the first recipients of the SROCC SPM. [European Union]
7738	SPM	0	0	0	0	Consistency with the special report on 1.5°C should be ensured throughout the report . On issues where the scientific knowledge has evolved since the cut-off date retained for the 1.5C report, it would be very policy relevant to hightlight the evolution of the policy-relevant scientific messages in the concerned areas. This could include highlighting differences between 1.5 degree and 2.0 degree scenarios (including beyond 2100). [European Union]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7740	SPM	0	0	0	0	The reference to the recent IPBES assessment comes very late in the draft SROCC report while such reference would be justified earlier in the text and in several of the places of the draft SROCC [European Union]
7742	SPM	0	0	0	0	General comment - add main headlines section at the start of the SPM The SPM would be greatly improved by adding an introductory section combining the main messages from across the sections. This could be ordered using the existing Legend (mountain, polar, sea level, ocean), and the existing headline statements (A1, A2 etc) could be a good starting point for this. For example, statements A3, B3, B9, C3 could form the basis of a single summary section on sea-level rise. A1.4 & B1.3 tell a coherent story about permafrost. Single summary statements on these issues would be much more powerful than the current distribution of these messages throughout the SPM. [European Union]
7744	SPM	0	0	0	0	General comment: warming/ temperature metrics Attention needs to be paid to the warming metrics used in this SPM. Wherever possible, the report should refer to GMST as the measure of global warming in order to aid comparability with the scenarios provided in SR1.5 and subsequent reports. Where alternative measures are needed, please use degrees Celsius where possible and explain the relationship between the different measures (e.g. SST is needed to refer to the temperature of the Sea Surface, and will be different from the GMST used as the overall global warming measure in scenarios). Also, consider if the Glossary entries for GMST, SST and Global Warming could be modified to further clarify the relationship between them. [European Union]
7746	SPM	0	0	0	0	General comment - reinforce headline statements (A1, B1 etc) with quantified evidence and/or illustrative examples It is important that policymakers can access the essential messages of the report. To this end, the headline statements should be strengthened and made more relatable. This can be done by promoting at least one statistic or illustrative example from the underyling section for each headline statement. [European Union]
7748	SPM	0	0	0	0	Please, make sure that the SPM is self-contained and understandable to policy makers. This would require explaining units like ZJ and less known phenomena such as Marine Heat Waves. [European Union]
7750	SPM	0	0	0	0	There is quite a lot of repetitions, not only between chapters but also in different paras of the same chapter. Clear writing and editing are needed. [European Union]
7752	SPM	0	0	0	0	General comment: consider re-ordering of statements Consider re-ordering the statements in sections A&B (and possibly C) on a thematic basis instead of differentiating between observations and projections. The impact and policy relevance of the statements is diluted by the existing separation. For several specific topics (in particular permafrost, coral, ocean stratification, fisheries) as well as major issues like sea level rise it would be better to place the evidence from historical observations alongside the forward-looking analysis. Often the policy-relevance of the "A" statements (which typically describe specific natural pheomena) is only apparent when they are read in conjunction with the "B" statements. This applies especially to some of the specific phenomena that reappear across the SPM - such as permafrost melt and ocean stratification. For issues such as these, some of the single statements are barely comprehensible to non-experts, but the combined statements provide a clear picture. Re-ordering in this manner would also allow for (near) duplicate statements to be reduced. For example, A8.1 begins by stating that the distribution and abudance of fish stocks has changed. This is essentially repeating A5.5. In addition, several statements in the current Section B make reference to response measures and their effectiveness (e.g., B7.2, B7.9, B9), which currently should go to Section C. Alternatively, response measures could consistently be discussed together with the projected impacts, where relevant. [European Union]
7754	SPM	0	0	0	0	General comment: timeframes It would be important to consistently include as much information as possible on the period beyond 2100. It would be particualrly important given the irreversibility and the inertia of some of the changes, which may not be grasped by all readers. [European Union]
8186	SPM	0	0	0	0	The focus of this report primarily includes changes in The Atlantic Meridional Overturning Circulation (AMOC), ENSO & La Niña events in the Pacific, the impact of climate change in Sahelian environment and impact on the cryosphere in Arctic & Antarctica. There is hardly any mention of the climate change impact on Wildlife/ marine life or vulnerability of climate change of millions of people specifically with respect to South Asian region which can be added in the document. [Government of India]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8188	SPM	0	0	0	0	The report presents a global picture with general references such as tropical, subtropical, polar regions etc. There are some specific references such as Pacific or Atlantic Basins, but there is no specific reference to Indian Ocean. However in Figure SPM.2, observed regional changes in Ocean and Cryosphere, the expected impact on tropical and temperate Indian ocean is presented, although without much discussion. [Government of India]
8282	SPM	0	0	0	0	We would like to see more high level comments in the summary about consequences for threatened species e.g. turtles, marine mammals and seabirds (which will be important indicators for ocean changes) i.e wider than just in the Arctic as in this draft [Government of New Zealand]
8536	SPM	0	0	0	0	It is striking and of concern that the SPM virtually lacks a long-term perspective beyond 2100. Only section B3.4 seems to talk about a perspective beyond 2100, indicating a multi-meter rise of sea level on a centuries to millenia time period for RCP8.5 (medium confidence). While the perspective beyond 2100 is not as strong as it could be in the underlying report, it is present in chapter 4 (e.g. the well-crafted Figure 4.2 and respective text). As has been widely echoed by the community it is absolutely critical that the SPM accommodates this long-term perspective, bringing over the relatively robust statements about the order of magnitude of future SLR which is likely even on the multi-meter scale for a 2°C. Consideration of associated fundamental questions of (inter-generational) justice questions would also be highly important. In any case, the perspective beyond 2100 (including related implications) should have much more space than in the current version (even though there is only limited literature on it). Please remember that this Special Report should represent THE reference for ocean, cryosphere and sea level rise over the next several years. [Government of Switzerland]
8538	SPM	0	0	0	0	Section C should convey in a clearer way that man actions are possible now. Like in the SRCCL, near-term action should be better indicated. The name of the section should be changed: "Near-term options for action". [Government of Switzerland]
8750	SPM	0	0	0	0	The SPM is rather long. Recent experience with the adoption of the SRCCL has shown that for adopting the same number of pages 6 days were necessary. For the adoption of the SROCC only 4 days are foreseen. Therefore it would be necessary that the authors consider providing a revised SPM including Government suggestions and also avoiding repetitions. Furhtermore, the Introduction should be rewriten taking into account the one of the SRCCL. The "burning bars and diagrams" shoud also be dealt with taking into account the approach of the SRCCL. The figures and the tables - and the related captions - should be considered in parallel to the plenary in a contact group. [Government of Switzerland]
1000	SPM	0	0	0	0	We would like to thank the authors for their work in preparing the Final Draft of this Special Report, the Ocean and Cryosphere in a Changing Climate. [Government of Australia]
1002	SPM	0	0	0	0	Suggest that at the beginning of the report include a brief explainer about the scenarios, e.g. "low" referring to RCP 2.6 and "high" referring to RCP 8.5 [Government of Australia]
1006	SPM	0	0	0	0	Suggest applying a consistent order for the "narration" in terms of comparing high and low emissions scenarios. These should always be in the same "direction" / order for better readability. E.g. "less frequent and more moderate marine heat waves in a low -emissions than a high-emissions scenario" and stick to this order. [Government of Australia]
1008	SPM	0	0	0	0	Suggest talking about the low-emissions scenario first in these comparative statements because: 1) this emphasises that this scenario is the preferred policy target and 2) it emphasises the (relative) benefits of the low-emissions versus the high-emissions scenario. [Government of Australia]
1010	SPM	0	0	0	0	Suggest the SPM needs a section summarising how this special report differs from the relevant coverage of the ocean and cryosphere in AR5. In general, it reads as "what was in AR5, only more so". [Government of Australia]
1012	SPM	0	0	0	0	Suggest the presentation of material in Sections A and B could benefit from expertise and consultation by a science communicator. Some of the text and figure descriptions may be difficult for policymakers without a scientific background to relate to and fully understand. [Government of Australia]
1014	SPM	0	0	0	0	Suggest Section C be brought to the front of the document since it contains information that would be of most relevance to policymakers. It would be best included after the Start-up Box - and then be followed by the current Sections A & B. [Government of Australia]
1016	SPM	0	0	0	0	In general, the SPM focuses heavily on RCP 2.6 versus RCP 8.5. Suggest the text also needs a section on what the minimum adaptation tasks are likely to be, either extrapolating current trends or projected under RCP2.6, or perhaps both. Because of the long time constants inherent in ocean heat uptake, ice sheets, ocean buffering of CO2 and other long time-constant processes, policy makers need to be apprised of what we are likely to have to adapt to, independent of scenario. The warming trajectory is likely to have "locked in" impacts on many marine ecosystems, especially tropical coral reefs. For these systems, adaptation will require focus and investment. [Government of Australia]

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1018	SPM	0	0	0	0	In general, there appears limited coverage of ocean acidification. Ocean acidification is arguably the most pervasive and persistent of emissions-related impacts on the ocean. Numerous publications document that ocean acidification impacts are already detectable, including in the Southern Ocean and the Great Barrier Reef. Examples include: Silverman, J., K. Schneider, D. I. Kline, T. Rivlin, A. Rivlin, S. Hamylton, B. Lazar, J. Erez, and K. Caldeira (2014), Community calcification in Lizard Island, Great Barrier Reef: A 33 year perspective, Geochim. Cosmochim. Acta, 144, 72-81, doi:10.1016/j.gca.2014.09.011. Moy, A. D., W. R. Howard, S. G. Bray, and T. W. Trull (2009), Reduced calcification in modern Southern Ocean planktonic foraminifera, Nat. Geosci., 2, 276-280, doi:10.1038/ngeo460. [Government of Australia]
1084	SPM	0	0	0	0	Suggest avoiding expressing statements about the future in terms of what WILL happen. 1) We don't know what will happen; we have insight into what is likely to happen under a particular emissions scenario. And we don't know which, if any, of the scenarios IPCC has analysed, we will follow. 2) Expressing a future outcome in terms of what will happen connotes that it is a foregone conclusion. We are trying to convey that we (humanity) has agency and has choices. The established certainty and confidence terminology allows the authors to express that some projected changes are more certain, and have higher confidence, than others. [Government of Australia]
1156	SPM	0	0	0	0	Suggest clarifying how confidence and certainty levels are defined. Suggest the grading statements be included for reference. [Government of Australia]
1534	SPM	0	0	0	0	The SPM as written does not truly reflect the many challenges and impacts on ocean and cryosphere on dependent communities in SIDS. [Government of Saint Kitts and Nevis]
4024	SPM	0	0	0	0	We recognise that the effect of ocean warming and acidification on aquaculture is poorly covered in the SPM and maybe also in the underlying report. Please consider including findings relevant to aquaculture which is now an important part of the fish production. Alternatively, if this is not possible to address these issues, please consider explaining why this is not included, e.g. if it is related to the amount of scientific litterature. We also feel that there are issues related to governance of aquaculture and fish farming that would be relevant for the SPM. [Government of Norway]
4026	SPM	0	0	0	0	In general, section A and B on ecosystem impacts could be more informative if it picked up more concrete examples on observed and projected changes [Government of Norway]
4028	SPM	0	0	0	0	Consider adding the "boxed" text in SROCC FAQ 3.1 into the SPM. These are important findings on the global impact of Arctic and Antarctic change. [Government of Norway]
4030	SPM	0	0	0	0	Invasive species and the relation to climate change seems a bit poorly coverd in the SPM. It is only mentioned in A4.1 in relation to mountain areas where glaciers have receded etc. and where they can contribute to increased local species richness. This does not cover the full range of potential impacts. Consider if these issues also could be coverd in a new and broader finding. Furthermore it may be usefull to cover possible adaption measures and goverance related to these impacts. [Government of Norway]
4440	SPM	0	0	0	0	First of all, Monaco would like to congratulate all authors for producing a high quality scientific report. All themes detailed in the 6 chapters and Cross-Chapter Box are well-documented, clear, and properly addressed. Ocean and cryosphere fundamental roles are articulated in a way that emphasizes the systemic aspect of climate change, which allows an exhaustive understanding of impacts on ecosystems and human societies. [Government of Monaco]
4442	SPM	0	0	0	0	We also commend all SPM authors for entirely re-writing the SPM after the second review, changing figures, and modifying the chapters' texts. The final governmental draft is a well-argued document, fulfilling the scientific needs and expectations. [Government of Monaco]
4444	SPM	0	0	0	0	An effort to improve readability of SPM has been noticed, in particular with the adding of a symbol before each paragraph. The different parts of SPM (A, B and C) are much more balanced than before, and document structure is much more relevant. Indeed, SPM.A and SPM.B have the same number of under-parts, corresponding to the same sharing between physical changes, impacts on ecosystems and impacts on human society, and their volume is now quite similar. Finally, it is worth having political messages in a summary devoted to policymakers, and SPM.C has been strengthened in this perspective, which is a good initiative although it is perfectible. [Government of Monaco]
4446	SPM	0	0	0	0	The six chapters and the Cross-chapter Box 9 are well balanced within SPM, and apart from rare exceptions, important information that can be found in SROCC is correctly summarized in SPM. From a scientific point of view, SPM is a very well-produced document. [Government of Monaco]
4448	SPM	0	0	0	0	Nonetheless, despite the efforts and positive remarks on SROCC final governmental draft, the SPM still remains very difficult to understand for policymakers, although they are supposed to be the main recipient of the document. The complexity of SPM is likely to dissuade policymakers to entirely read this document by themselves. To provide a specificexample, ocean warming is expressed in zeta joules that are not a common unity for policymakers. Moreover, the Technical Summary seems to be less difficult to understand than SPM, partly because its structure, based on chapters, is more apparent. [Government of Monaco]

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4450	SPM	0	0	0	0	In addition, SPM is a very long document, providing too much information: a twenty-eight-pages long document is not a summary that policymakers can easily read and digest. The wording is not adapted to non-scientists, which makes this SPM hard to understand. Indeed, the use of technical terms is recurrent and does not allow for an easy reading. The sophistication of figures well illustrates this complexity. Moreover, in the current form, neither the SPM structure nor the paragraphs' main idea are clearly highlighted. Therefore, the clarity of the document could be improved with enhanced page layout. [Government of Monaco]
4452	SPM	0	0	0	0	Furthermore, the level of confidence should be a criterion to decide whether or not to highlight a particular fact whereas it currently is an information. In order not to overcomplicate the text, it is suggested to only report high, very high confidence data, and likely to virtually certain statistical likelihood in the boxes of sub-parts (A2., A5., A8., B3., B4. B5. B7., B8., and B9.). [Government of Monaco]
4454	SPM	0	0	0	0	In paragraphs, we agree it is a good point to give information, even if it is stated as medium confidence, as it is a first scientific positioning on an exploratory thematic, or the actual state of the art. [Government of Monaco]
4456	SPM	0	0	0	0	More precision is needed when qualifying the impacts of climate change by "positive", or "negative" (A4.3), which can seem subjective. Similarly, the term "ambitious" (B9.3) or "strong" (B3.3), when talking about adaptation, should be detailed and clarified. [Government of Monaco]
4458	SPM	0	0	0	0	For the sake of transparency, reviewers underlined it is important that SPM also mentions positive impacts of climate change, when evidence exists. Positive comments will be perceived as a sign of balance by some policymakers, especially from countries that are usually reluctant to recognize scientific conclusions on climate change. Therefore, it is important not to occult any positive impacts of climate change. [Government of Monaco]
4460	SPM	0	0	0	0	Some phenomena are attributed to anthropogenic drivers and causes (A2.2, A2.3, A3.6…). In these paragraphs, an accurate percentage of a phenomenon is attributed to anthropogenic causes, which lets policymakers think that a part of this phenomenon is attributed to other causes (e.g. approximately half of the observed sea ice loss is attributed to anthropogenic global warming (medium confidence)). This should be clearer and mention the other causes. [Government of Monaco]
4462	SPM	0	0	0	0	The architecture of the document corresponds to an interesting logic. However, this structure is different from that of the chapters. This is not easily understandable when reading the document directly, and by now, Annex I: Glossary, and Technical Summary are necessary to fully understand the SPM. An explanation could help to introduce the document. In this sense, right from the introduction part, "reading instructions" could be provided to help policymakers to understand the SPM structure and better find the information they are looking for. [Government of Monaco]
4464	SPM	0	0	0	0	This document should start with a Table of contents. Especially for parts A and B, it is essential that policymakers understand that Part A only focuses on observed changes, and that Part B only covers projected changes. [Government of Monaco]
4466	SPM	0	0	0	0	Then, sequencing between "Physical changes", "Impacts on ecosystems" and "impacts on human society", and between "cryosphere", "ocean" and "coasts" should be clearer. A table can very easily present this sequencing : a table with 3 columns 'Physical changes' / ' Impacts on ecosystems' / 'Impacts on human society'and with 3 rows 'Cryosphere (High Mountains + Polar Regions)' / 'Ocean' / 'Coasts' By noting table T, the final table could be proposed as followed (as a matrice) : T(1,1) = 'A.1 ; B.1' / T(1,2) = 'A.4 ; B.4' / T(1,3) = 'A.7 ; B.7' / T(2,1) = 'A.2 ; B.2' / T(2,2) = 'A.5 ; B.5' / T(2,3) = 'A.8 ; B.8' / T(3,1) = 'A.3 ; B.3' / T(3,2) = 'A.6 ; B.6' / T(3,3) = 'A.9 ; B.9' / [Government of Monaco]
4468	SPM	0	0	0	0	The scope of the report must appear in the introduction. In particular, it is important to recall SROCC positioning with respect to the Paris Agreement adaptation and mitigation processes (Cf. 1.6.1). Indeed, mitigation receives very little interest in SROCC, while it is a very important subject for the ocean and climate change nexus, as well as a pillar of the Paris Agreement. [Government of Monaco]
4470	SPM	0	0	0	0	In the main text of the introduction rather than in a footnote, it should be recalled how and which types of new scientific literature is assessed. [Government of Monaco]
4472	SPM	0	0	0	0	Similarly, calibrated language deserves to be highlighted and introduced. Rather than in the Technical Summary, Figure TS.1 could be included in the introduction to illustrate the IPCC use of calibrated language. [Government of Monaco]
4474	SPM	0	0	0	0	Because SROCC does not answer all questions policymakers can have, it is important to point out how knowledge gaps are covered. Moreover, to avoid any misunderstanding, difference between a knowledge gap and calibrated language (e.g. something very low confidence) should be clarified. [Government of Monaco]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
4476	SPM	0	0	0	0	Representative Concentration Pathways (RCP) are not instinctive for policymakers. RCP exposed in terms of atmospheric carbon dioxide concentration is relevant for scientists, but are an abstract concept for policymakers. This must be translated in a percentage of future emissions increase or decrease, and provide concrete information: how many percent of CO2 emissions should be reduced to stick to the low emission pathway? [Government of Monaco]
4478	SPM	0	0	0	0	It should be specified that references to other SROCC documents presented in brackets, e.g. {4.3.2, Figure SPM5}, are here to inform policymakers that the matter in question is detailed somewhere else in SROCC. [Government of Monaco]
4480	SPM	0	0	0	0	It is very relevant to introduce symbols before paragraphs. Two remarks can help to improve the relevance of this caption. [Government of Monaco]
4482	SPM	0	0	0	0	Concerning headings of symbols, it corresponds to a geographical breakdown, except for “Sea level rise” in “Sea level rise and coasts” caption, which is a phenomenon. It is suggested to change the name of this heading by deleting “Sea level rise” and keep “Coasts” or “Coastal areas”. [Government of Monaco]
4484	SPM	0	0	0	0	Concerning the symbol of the ocean, it can lead to confusion. The graphic display of a coral may reduce the ocean to this specific ecosystem. A symbol with the same wave, plus a marine animal and/or a marine plant could be more appropriate. [Government of Monaco]
4486	SPM	0	0	0	0	Topics covered by chapters and Cross-chapter Box 9 are well balanced in the SPM. Especially between cryosphere and ocean; between physical changes, impacts on ecosystems and human society, as well as between observed changes and projection. The two first parts are a very good summary of the entire special report. [Government of Monaco]
4488	SPM	0	0	0	0	However, Part C contrasts with the rest of the document and seems less documented than other two parts. Moreover, some themes are not, or not enough debated in the SPM. In a document addressed to policymakers, this part needs editing and concrete solutions to mitigate and adapt to climate change. [Government of Monaco]
4490	SPM	0	0	0	0	SPM is addressed to policymakers, but Part C appears as less well-designed than the other two parts. It is a shorter part which does not deliver concrete messages. For instance, many solutions referred to in chapter 5 (Table 5.8) are not mentioned in the SPM. [Government of Monaco]
4492	SPM	0	0	0	0	To improve this part, the sequencing between “Challenges”, “Options” and “Enablers” could be more explicit. It is not easy to understand what these sub-parts refer to. Therefore, titles could be turned into small sentences instead of just one word. [Government of Monaco]
4494	SPM	0	0	0	0	Reviewers noticed than some themes are not discussed or not enough. Although it is difficult to make changes after this review, more editing would be appreciated on the following topics: [Government of Monaco]
4496	SPM	0	0	0	0	1. If adaptation to climate change and adaptation measures are well developed in the SPM, mitigation measures such as blue carbon are not present. However, this is addressed in chapter 5, 5.4, 5.5. It is a very important topic to communicate to policymakers, as it is one of the solutions to mitigate climate change. On the same topic, very little information is presented on emission due to destruction of habitat, which has the capacity to sequester organic carbon. [Government of Monaco]
4498	SPM	0	0	0	0	2. Solutions to adapt and respond to sea-level rise are very briefly introduced, and not entirely expressed as they are in Box 4.3 Figure.1. [Government of Monaco]
4500	SPM	0	0	0	0	3. Especially in the inter-tropical area, the shift in stocks distribution will impact coastal communities. In B8. the projected impacts of climate change on fisheries is too quickly discussed, and comes with thirteen medium confidence out of thirteen calibrated language. [Government of Monaco]
4502	SPM	0	0	0	0	4. Although millions of people are threatened by sea-level rise, the term of migration, associated to human populations, is not presented as an impact of climate change on human society. (Cf. 4.3.3.6) [Government of Monaco]
4504	SPM	0	0	0	0	5. On a similar topic, there can be a confusion between “retreat” and “migration”. In Box 4.3, “migration” is defined as a form of “retreat”. Indeed, retreat is a solution to sea level rise, but migrations are not. Moreover, especially in small low-lying islands, retreat cannot be presented as a solution, as it corresponds to a migration on other islands or lands. Caution is needed about this very political subject. To encourage SPM approval, the difference with relocation (A7.3) should also be clarified. [Government of Monaco]
4506	SPM	0	0	0	0	6. Nature-based solutions are mentioned on several occasions, but a comprehensive message on political measures is missing. Implementing nature-based solution is a long-term process that is preferable to implement as earky as possible. [Government of Monaco]
4508	SPM	0	0	0	0	When possible, paragraphs about the same theme should be positioned one after the other (e.g. B2.2 and B2.4), and very similar paragraphs can be gathered (e.g. A2.1 and A3.3). [Government of Monaco]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4510	SPM	0	0	0	0	Improving the readability of the SPM can also help to reduce the entire SPM volume. a lot of information is given in the SPM, it could be wise to decide to only refer to RCP2.6 and RCP8.5. References to other RCP are additional data that can be confusing (e.g. B5.2). In the same way, projections can be presented for horizon 2100, or for the period 2081-2100, depending on available data) but not both, which is also confusing (e.g. B.3.1). [Government of Monaco]
4512	SPM	0	0	0	0	Finally, all graphs are difficult to understand. They contain too much information, have overly complicated captions, and are absolutely not adapted to policymakers. [Government of Monaco]
4514	SPM	0	0	0	0	A few errors have been noticed, and are underlined in specific comments. Somewords are to be harmonized: - Sea-level rise/Sea level rise; Heatwaves/heat waves - The presentation of figures is to be harmonized as well, e.g. “15.0±5.9” or “15.0 ± 5.9”. - Some units are inconsistent: yr-1 (A3.3), should be as superscript. - The use of the word “retreat” for both population and glaciers can be confusing. It needs to be clarified. - Similarly, the use of the word “migration” for both human population and for animal or vegetal species can be confusing. [Government of Monaco]
7408	SPM	0	0	0	0	The length of the report vastly exceeds the proposed length mentioned in the outline of the SROCC as annexed to the Decision IPCC/XLV-2, in which the total number of pages is stipulated as up to 280. Although the number of pages for the Summary for Policymakers (SPM) is a reviewable volume (28 pages in the current Final Draft for Government Review), the current volume of the Final Draft of the entire report (1,189 pages) tends to place a heavy burden on the policy makers, in the endeavor to fully understand the SPM and submit the best quality of government review comment within the allocated review period. Thus, we would appreciate further consideration regarding the length of the special reports in the AR7. [Government of Japan]
2582	SPM	0	0	28	0	Much of the SPM is written in over-formal, stilted language, with complicated phrases and technical jargon. Some examples and suggested changes are given for sections A and B. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3674	SPM	0	1	28	1	This is a well written and informative report on key parts of the Earth's climate system [Government of Ireland]
3774	SPM	0	1	28	1	Some messages could be enhanced or made clearer for policy makers [Government of Ireland]
3776	SPM	0	1	28	1	For policymakers the RCPs should be clearly linked with terms in the policy areas e.g. RCP2.6 is consistent with Paris Agreement and high emissions RCP are business as usual [Government of Ireland]
3778	SPM	0	1	28	1	The text should refer to warming in C being linked to additional energy being trapped by Long life GHGs especially CO2. This link is key for ocean warming and sea-level rise. Oceans will react for centuries to gases that will have atmopsheric impacts for centuries. This dual commitment should be clearer in the SPM [Government of Ireland]
2580	SPM	1	0	28	0	The RCP 2.6 vs 8.5 framing used throughout for impacts and projections feels somewhat old fashioned. It is of course useful to see what might happen in a high end warming scenario. However, we are now in a post-Paris world. It would be more useful for a policy audience to include scenarios for a 1.5C, 2C and a current NDC world to help understand what risks are posed by a 3 degree warming scenario. This will inform policy-makers about the risks posed by our current trajectory and provide a clear rationale as to why great ambition on existing NDCs is required. It also creates difficulties for comparison with SRCCL and SR1.5 which do not focus on these same RCPs. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2584	SPM	1	0	28	0	The SPM includes a greater focus on adaptation to sea level rise and coastal challenges vs adaptation in the cryosphere. A more balanced discussion of adaptation across both realms would be beneficial, or if this is not possible an explanation for why there is a greater focus on coastal communities (i.e.e knowledge gaps in cryopshere adaptation research?). [Government of United Kingdom (of Great Britain and Northern Ireland)]
2586	SPM	1	0	28	0	Suggest that grouping all adaptation messages in section C, under a broader section on response options would be useful for policymakers wanting to know how to respond to these challenges. This would also include information on mitigation, where some of the messages on the scale and speed of mitigation actions could be highlighted. It would be helpful to also include information on the impacts projected towards the end of the century under high emission pathways and the co-benefits of emissions decline, as well as information on the risk of the risks of irreversible thresholds/tipping points that make the case for reducing emissions (e.g. AMOC weakening, ice sheet collapse) - this would clearly communicate the mitigation and adaptation actions required to address the challenges outlined in Sections A and B. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
2588	SPM	1	0	28	0	Overall, it is quite difficult to pull out key messages from the SPM. This is in part due to the structure (observed changes in each system, followed by projected changes). It would be more useful to construct a narrative, and to start with an introduction (importance of ocean and cryosphere service, role in the carbon cycle) and begin the impacts section with key messages that can be generalised across all systems (e.g. there are committed changes regardless of future emissions pathway (thus we should adapt), some of these last beyond 2100, our actions now determine those future impacts (thus we should mitigate)), before going into specific systems in more detail e.g. grouping all the messages relating to permafrost together, grouping all the messages related to coral reefs together, grouping all the messages related to glacier together - allowing a more useful narrative to develop. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2590	SPM	1	0	28	0	Please ensure the use of Loss and Damage/losses and damages in the report chapters and SPM are consistent with the definition in the glossary. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2592	SPM	1	0	28	0	There are multiple occasions where "cultural" or "culture" are used, where really the references are broader, and fall under the broader definition of "social". "Culture" is just one part of the "social" aspects of climate change, and indeed, many people would even differentiate "cultural" from "social". The effect of this across the whole report is to diminish the importance of social aspects of climate change. Often, policy-makers will prioritise social sustainability/aspects over cultural sustainability/aspects, and so lack of use of the term social (and derivatives) risks the importance of social aspects of this work being overlooked. In the latter pages, from p. 24, line 55, "social" does seem to be well integrated, we recommend that retrospective editing would be a good approach. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3088	SPM	1	1	28	1	Indigenous Knowledge: A unique feature of this Special Report is the recognition of Indigenous Knowledge (IK) and the participation of Indigenous Peoples (though this could be greatly enhanced). For example, ICC Canada President (Monica Ell-Kanayuk) provided a piece for the cross-chapter box on IK. In this piece, the importance of partnership and self-determination for Inuit (and Indigenous Peoples more broadly) in research and global assessments like the IPCC is emphasized. As such, we would like to see a point in the SPM when IK is mentioned that notes the importance of understanding and engaging with IK in a way that understands, respects, and promotes Indigenous rights. [Government of Canada]
7406	SPM	1	1	28	2	There are a number of High Mountains in Africa that need to be reflected in the Report. This includes: Mt. Kilimanjaro (5895 m), Mt. Kenya (5199 m), Mt. Rwenzori (Stanley, 5109 m), Mt. Simien in Ethiopia (4533 m), the Atlas Mountain in North Africa, and the Drakensberg Escarpment in South Africa. [Government of United Republic of Tanzania]
1558	SPM	1	1	28	28	Unfortuntately there is no even a single mention of Africa or the Highest Mountain in Africa, Mt. Kilimanjaro. This is not acceptable. There are cryosphere in Africa and are vulnerable and impacted by climate change. [Government of United Republic of Tanzania]
1560	SPM	1	1	28	28	The entire report is not balance interms of regional representation of the findings. All Chapters have note adequatelly reflected the issues in Africa. The SPM does not speak any finding about Africa. We strongly Object and We request the Author to seriously looks at these from the Chapters to the SPM. It is extremely worrying that even under High Mountain Chapter, Mt. Kilimanjaro is not even Mention. While in Chapter 6 on Extremes, Africa is not adequately reflected. It is not acceptable. [Government of United Republic of Tanzania]
8748	SPM	1	1	1	40	No mention of Small Island States (SIDS) appears - please include SIDS in th context of limits and costs to adaptation and the loss and damage due to slow onset events [Government of Grenada]
1554	SPM	1	3	1	12	We suggest the introduction follow the pattern used in the SR CCL. This report respond to the Decision of Panel to prepare three special report following proposals submitted by Governments and Observer Organization [Government of United Republic of Tanzania]
7686	SPM	2	1	2	34	definitions shall be included. We see a definition for cryosphere in line 16 of page 2, but it is misplaced (it shouldn't be under the importance of oceans and cryosphere for people"). The definition should be relevant enough to have its own box. In addition to this, we can't see a definition of ocean, or even a description of what the special report has analized as part of ocean. This shall be included. [Government of Spain]
7684	SPM	2	1	28	31	structure must be improved. In particular, the use of tables for all numerical information on impacts and periods, with their associated uncertainties should be considered. Text should be easier to read, there are paragraphs that are hard to read even for scientists. Policy makers won't look at them. There is also misplaced text all across the document, responses in the impacts part, challenges in options part,... [Government of Spain]
4260	SPM	2	5	2	5	Cut-off dates should be in the body text. [Government of Monaco]
4062	SPM	2	6	2	8	Please consider describing the difference between the 1.5C report and this special report regarding the levels of global warming adressed. [Government of Norway]
1316	SPM	2	7	2	8	Please also refer to the Special report on Climate Change and Land. [Government of Luxembourg]
2594	SPM	2	7	2	8	The point that the SROCC 'has been produced alongside other IPCC reports' does not add much; suggest that the introduction emphasises that the IPCC reports are complementary and should be viewed together in context. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4262	SPM	2	7	2	8	It would be useful to recall that the special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, is also part of the Sixth Assessment Reports. [Government of Monaco]
4714	SPM	2	7	2	8	Suggest to replace the phrase "The SROCC has been produced alongside other IPCC reports, including the Special Report on Global Warming of 1.5°C." by "The SROCC builds on findings since the IPCC Fifth Assessment Report (AR5) and, whenever applicable, outcomes of the IPCC Special Report on Global Warming of 1.5°C (SR15).", using the formulation from TS p3. The relevant information for the reader is how the SROCC relates to other IPCC reports. Whether or not other reports have been produced in parallel is of no particular concerns within a SPM. [Government of Germany]
7756	SPM	2	7	2	8	The Special Report on Land should also be mentioned as they cover related issues and slightly overlap (e.g. on permafrost degradation). [European Union]
512	SPM	2	10	2	12	"(observed changes, projected changes, responses)": Please use harmonized names for the sections. Additionally, we suggest specifying the sections while mentionning the structure of the SPM, for example rephrasing as : "A) Observed changes and impacts, B) Projected changes and risks, C) Responding to Changes: Challenges, Options and Enablers" [Government of France]
6204	SPM	2	10	2	12	The Introduction is too brief. Addition of some language from the paragraph beginning with "The commissioning of this special report…" on page 1-7 of the underlying report would help provide context for this SPM. Also include text that describes the overall structure of the report, such as found on page TS-3, where the second full paragraph describes the contents of the various chapters. This would help set the stage for the summary, which as currently written seems like just a list of statements/facts without the context of what's in the full report. A variation of Table TS.1 might help. [Government of United States of America]
3100	SPM	2	10	2	34	Unsure what responses means here. Since this is a general summary that will be read by individuals with a wide range of understanding, it is recommended that the three terms (observed changes, projected changes, and responses) be described in a footnote. [Government of Canada]
4264	SPM	2	11	2	12	These are not the right names of parties. Should be harmonized. [Government of Monaco]
1024	SPM	2	12	2	12	Suggest inserting 'to climate change' after 'responses'. [Government of Australia]
4266	SPM	2	12	2	12	Copy and add the Figure TS.1 in SPM. [Government of Monaco]
8622	SPM	2	12	2	12	footnote 3: "Assessed likelyhood is typeset in italics, e.g. very likely". Suggest to change to "Assessed likelihood is typeset in italics, e.g. very likely". [Government of Netherlands]
3418	SPM	2	14	2	14	"Startup Box" sounds strange. Just "Box" should suffice here, as the box already is in "introduction" context. [Government of Sweden]
3780	SPM	2	14	2	14	Use different name for box e.g. Context [Government of Ireland]
4268	SPM	2	14	2	14	Reminding that the project changes and trends are analyzed against RCP2.6 and RCP8.5. [Government of Monaco]
4270	SPM	2	14	2	14	Associate the RCP2.6 to a quantitative emission reduction pathway, in order to give a meaning to the reading of RCP references. [Government of Monaco]
3784	SPM	2	14	2	19	For context pehaps provide numbers of total water; total fresh water and total frozen fresh water and frozen water [Government of Ireland]
3102	SPM	2	14	2	34	What's missing from this box is a strong rationale for why the two topics – oceans and cryosphere – were put together into one Special Report. This is important to establish at the outset, as it sets the stage for a coherent narrative to be presented through the headline statements, across both topics. [Government of Canada]
3620	SPM	2	14	2	34	SIDS are particulary vulnerable regarding ocean related changes and key stakeholders of this report. The Startup Box refers to mountain and polar regions, but coastal environments only in very general terms. We ask the authors to reflect and introduce the unique vulnerability of SIDS in the Startup Box. [Government of Nauru]
4098	SPM	2	14	2	34	The startup box and the use of coloured boxes to highlight key messages (e.g. the importance of the ocean and cryosphere for people) was useful for absorbing and navigating the document. Please retain these. Please also consider adding the important role the ocean has in regulating the climate and weather/wind systems. The link between ocean and climate is somewhat missing here. Please also consider adding a definition of "Arctic region" to the glossary. [Government of Norway]
6206	SPM	2	14	2	34	The importance of sea ice formation for the global haline circulation is not mentioned. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
514	SPM	2	14	3	5	We welcome the introduction of a start up box, and thank the autors for taking into account the comments from the previous review. In this start up box, we suggest highlighting the importance of ocean for people and life on earth by mentioning additionally the following topics : - Specify the link between ocean and life/biodiversity : "Ocean supplies 99% of the Earth's biologically-habitable space, and provide roughly half of the primary production on Earth" (Box 1.1) ». We sugggest emphasising that it provides half of the oxygen present in the atmosphere. - the importance of ocean for food security in some regions. Please find details in chapter 5, p.5-83 : « Seafood provides protein, fatty acids, vitamins and other micronutrients essential for human health such as iodine and selenium (Golden et al., 2016). Over 4.5 billion people in the world obtain more than 15% of their protein intake from seafood, including algae and marine mammals as well as fish and shellfish (Béné et al., 2015; FAO, 2017)). Around 1.39 billion people obtain at least 20% of their supply of essential micronutrients from fish (Golden et al., 2016). IPCC SR1.5 concluded that global warming poses large risks to food security globally and regionally, especially in low-latitude areas, including fisheries (medium confidence) (Hoegh-Guldberg et al., 2018). » [Government of France]
986	SPM	2	14	3	5	Start up box makes no mention to Small Island Island Developing States as one of the most vulnerable groups. There is also no mention of limits to adaptation resulting in loss and damage in ocean and cryosphere dependent communities. Cost of adaptation should also be included. [Government of Jamaica]
1522	SPM	2	14	3	5	Request to include Small Island Island Developing States as one of the most vulnerable groups in the start up box. Further, strongly recommend to include cost of adaptation as well as limits to adaptation resulting in loss and damage in ocean and cryosphere dependent communities. [Government of Saint Kitts and Nevis]
2596	SPM	2	14	3	5	As the subsequent sections of the SPM launch straight into the impacts of climate change, it might be useful to have a short section A that covers the importance of oceans for humans in more detail than currently in the Startup Box, to give context to the rest of the report. This could contain sections currently in chapter 1 of the underlying report such as "In the Indus and Ganges river basins, for example, snow and glacier melt provides enough water to grow food crops to sustain a balanced diet for 38 million people, and supports the livelihoods of 129 million farmers (Biemans et al., 2019)." and "around 17% of the non-grain protein in human diets is derived from the ocean (FAO, 2018)", (both from page 1-6 of chapter 1 of the underlying report). Such an introduction should also give high level details about the role of oceans in the carbon cycle (e.g. page 1-10 of section 1.2). More details about the characteristics of ocean and cryosphere changes (e.g. to support the point about 'thresholds of abrupt change and irreversibility', could be taken from pages 1-10 of the underlying report. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4522	SPM	2	14	3	5	Please make it shorter and in para 3: bring coastal zone impact upfront instead of the Arctic one.It is better to start with the big impact. [Government of Belgium]
4720	SPM	2	14	3	5	The Start-up box provides a good start and framing for the SROCC and we support its inclusion in the SPM. However it should be more clear in highlighting such important characteristics of the O&Cr as inertia and committed impacts, irreversibility and risks of abrupt change, and the lock-in effect of all past and future emissions. We'd recommend to rephrase p-2 ln 33ff to read "Due to system inertia/slow response times of the ocean and cryosphere, past and current human-induced greenhouse gas emissions and ongoing global warming will lead to/have locked in unavoidable and irreversible changes over decades to centuries, including the risk of crossing thresholds of abrupt change." As all future emissions will lock in additional change and heighten the risk of crossing thresholds of abrupt change, the next statement on p3 ln 1-3 should be revised to strengthen the importance of stringent near term mitigation, while at the same time highlighting the need for adaptation. At the moment, the sentence seems to argue that "past emissions have locked in future impacts, so we need adaptation", which is true, however in particular to avoid escalating risk, mitigation is essential. So we'd suggest to rephrase along the following lines: "in order to avoid escalating impacts and manage risks, stringent GHG mitigation actions is needed accompanied by ambitious adaptation of ecosystems and societies to ocean and cryosphere change." [Government of Germany]
4722	SPM	2	14	3	5	Please consider to include Figure TS.2 here, as an illustration of key components and changes of the ocean and cryosphere, and their linkages in the Earth system. [Government of Germany]
6208	SPM	2	14	3	5	Adaptation is mentioned as necessary, but mitigation is not. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6210	SPM	2	14	3	5	The Startup Box does not do a very good job of stating the importance of the ocean and cryosphere to people. The list of services in paragraph 2 is not very coherent. Maybe if ecosystem services were separated from economic/aesthetic benefits the statements would have more impact. The pairing of "services" listed seems random: 1) uptake and redistribution of anthropogenic carbon dioxide and heat by the ocean, 2) food production and ecosystem support, 3) supply of freshwater and renewable energy, and 4) benefits associated with health and wellbeing, cultural values, tourism, trade, and transport. In paragraph 3, should the statement "Human communities in close connection with polar, mountain, and coastal environments are particularly exposed to ocean and cryosphere change" be prefaced by what the changes are? In paragraph 4, the first sentence is convoluted. What does it even mean? What is meant by "responses . . . include . . . thresholds of abrupt change"? What is the take away message for a policymaker? The rest of the paragraph is not any clearer. [Government of United States of America]
7688	SPM	2	14	3	5	We think that the box is useful, but the content should be improved. First, the definition of cryosphere should be moved to a specific box on definitions, together with a definition or description of "ocean". Second, we would delete "for people" from the title. [Government of Spain]
3676	SPM	2	15	2	15	No need for"stretching" perhaps linking or connecting [Government of Ireland]
6212	SPM	2	15	2	15	Describing the global ocean as stretching from "the poles to equatorial regions" is not helpful and implies there is ocean near the south pole. Suggest "from the Arctic Ocean to the Southern Ocean including temperate and tropical oceans and contains about 97%..." [Government of United States of America]
6214	SPM	2	15	2	15	Insert a comma before 'stretching' and after 'regions'. [Government of United States of America]
516	SPM	2	15	2	16	Missing information for the importance of the ocean for the people, and unbalanced to the long list for the cryosphere. Missing elements for the ocean include: Oxygen & biodiversity reservoir, a fundamental driver (ocean currents, air-sea interaction) for weather and climate from local to global scales and from short to long time scales (triggers Earth inertia); coastline and ecosystem services. [Government of France]
4272	SPM	2	15	2	16	Add : "Ocean supplies 99% of the Earth's biologically-habitable space, and provide roughly half of the primary production on Earth" (Box 1.1) [Government of Monaco]
1162	SPM	2	16	2	18	The definition of cryosphere here does not contain submarine permafrost or solid precipitation – two cryospheric components. It is suggested to further refine it as defined in AR4&AR5 WGI. For example, cryosphere consists of glacier (mountain glacier, ice cap and ice sheet), frozen ground (permafrost and seasonal frozen ground), snow cover, lake and river ice, sea ice, ice berg, ice shelf, and ice in atmosphere. [Government of China]
6216	SPM	2	16	2	18	Note that the cryosphere contains the majority of the Earth's freshwater since following the 97% statistic referring to the ocean the cryosphere sounds vastly less important. [Government of United States of America]
6218	SPM	2	18	2	19	The Startup Box details how crysosphere holds 69% of Earth's freshwater. It might also be effective to add what this means in the context of providing drinking water to arctic communities. [Government of United States of America]
7758	SPM	2	19			Insert after "habitats": "for plants and animals" to read: "... habitats for plants and animals". [European Union]
3782	SPM	2	19	2	19	How much water does the crysphere hold? [Government of Ireland]
4524	SPM	2	19	2	19	So this would mean that 30% of the earths' freshwater (3% of earths water) is not covered by this report ? [Government of Belgium]
518	SPM	2	19	2	21	"the climate system through global exchange of water, energy and carbon.": We suggest giving a broader picture mentioning "biogeochemical elements (predominantly carbon, nitrogen, oxygen, and hydrogen)" as it is done in Chapter 1 (p.1-9)instead of "carbon" only. We also suggest adding "momentum". Therefore, the end of the sentence would be: "the climate system through global exchange of water, energy, momentum and biogeochemical elements (predominantly carbon, nitrogen, oxygen, and hydrogen)." [Government of France]
2602	SPM	2	20	2	20	Suggestion to add: 'with each other and', between 'interconnected' and 'with'. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1164	SPM	2	20	2	21	The exchange between and among the ocean and cryosphere and the other spheres involves not only water, energy and carbon, but also other chemicals, such as nitrogen and sea salt aerosols, which has a significant impact on the climate system. It is suggested that "water, energy and carbon" be changed to "water, energy, carbon and other chemical composition". [Government of China]
3678	SPM	2	21	2	21	It is not just carbon perhaps a more generic startment on nutrients, gases etc [Government of Ireland]
4724	SPM	2	22	2	22	Suggest to insert "Ecosystems" here, so the sentence reads "Ecosystem and other services provided to people..."; this will help explain the terminology "ecosystem services" used later in the text. [Government of Germany]
6220	SPM	2	22	2	22	It would be more accurate to say that all people on Earth depend directly on the ocean (delete "indirectly" or find a way to rephrase). More than half of the oxygen humans breathe comes from marine photosynthesizers, and that is not an indirect dependency. [Government of United States of America]
6222	SPM	2	22	2	22	Change 'or' to 'and/or' as many people depend on the ocean and cryosphere both directly and indirectly. [Government of United States of America]
3786	SPM	2	22	2	24	Rework for clarity: its is not just anthropgenic carbon dioxide, and perhaps excess energy as heat? [Government of Ireland]

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Comment id	Chapter	From page	From line	To page	To line	Comment
520	SPM	2	22	2	25	0cean and cryosphere play also a role in regulating the local and regional climate which could be added to the list of services provided to people. [Government of France]
4726	SPM	2	22	2	25	What is meant by "ecosystem support" at this point? What kind of service to people is covered by that expression? Please consider to clarify in the following revision: Ecosystem and other services provided to people by the ocean and/or cryosphere include the uptake and redistribution of anthropogenic carbon dioxide and heat by the ocean, coastal protection, ecosystem support for food supply and production, supply of freshwater and renewable energy, and benefits associated with health and wellbeing, cultural values, tourism, trade, and transport. [Government of Germany]
6224	SPM	2	22	2	25	This sentence lists "ecosystem support" as one of the services provided to people by the oceans and cryosphere. The phrase "ecosystem support" seems a little vague, especially given that the Startup Box is meant to provide an initial summary of the ocean/cryrosphere's importance. Is there more concrete terminology that can be used instead (e.g., foster biodiversity and ecosystem function)? [Government of United States of America]
6226	SPM	2	22	2	25	Move or preferably delete the 'uptake and distribution' example of ecosystem service. Seems like a poor example to try and relate to policymakers … especially when listed first and so high up in the document. [Government of United States of America]
7760	SPM	2	22	2	25	Replace "ecosystem support" with "habitat for biodiversity". Rationale: biodiversity is valuable for people on its own right. "Ecosystem support" is a bit unclear, as ocenas and the cryosphere are themselves ecosystems. [European Union]
7690	SPM	2	23	2	23	delete "anthropogenic". Oceans and Cryosphere redistribute CO2, without selecting which of these gases are anthropogenic and which don't. [Government of Spain]
6228	SPM	2	23	2	24	The oceans do not distinguish between anthropogenic carbon dioxide and heat and those from other sources. This statement should be revised to remove "anthropogenic." [Government of United States of America]
6230	SPM	2	23	2	25	This section does not include the natural cooling provided by the polar regions that drives ocean circulation patterns that when disrupted - less sea ice in the Arctic - could result in massive changes to the Gulf Stream and other currents that have established life as we know it. Add something to the effect that the ocean and cryosphere 'drives the global conveyer belt by forming cold salty water that drives global ocean currents'. [Government of United States of America]
3680	SPM	2	23	3	2	It is the response to excess energy trapped by GHG not the gases themselves apart from CO2 [Government of Ireland]
4728	SPM	2	25	2	26	Suggest to revise beginning of paragraph 3 as follows: Changes in the ocean and cryosphere will impact all people on Earth. But human communities … [Government of Germany]
6232	SPM	2	26	2	26	Insert 'that exist' -- that is, "Human communities that exist in close connection…" [Government of United States of America]
522	SPM	2	26	2	27	Please consider adding a mention to people living downstream mountain regions (or outside polar regions) but directly dependant on cryospheric changes overthere. See chapter 2 for examples. These population can not be neglected (p.2-33 : "In India and Pakistan, where over 100 million farmers receive irrigation from the Indus and Ganges Rivers, which also have significant inputs from glaciers and snowmelt, also face risks of decreasing water supplies from cryosphere change by 2100 (Biemans et al., 2019; Rasul and Molden, 2019).") [Government of France]
3788	SPM	2	26	2	28	Communities far from cyosphere are also vulnerable [Government of Ireland]
1166	SPM	2	26	2	32	The report uses "mountain" in line 26 and "high mountain" in line 30. In order to improve the textual accuracy, it is suggested that the "mountain" in line 26 be replaced with "high mountain" and that the authors check the relevant expressions across the text altogether. [Government of China]
3104	SPM	2	26	2	32	It would be helpful to show what percentage of Indigenous Peoples live in polar, mountain and coastal environments (not just in polar regions) to reflect the importance of these areas to Indigenous Peoples. An estimate of the number of Indigenous peoples along coastlines is stated in Chapter 5 (5.4.2.2.1) [Government of Canada]
4716	SPM	2	26	2	32	It would be helpful to include an estimate of the number of people that directly depend on melt-water from Glaciers as their main freshwater source. The significance of High Glaciated Mountain Regions as the world's water towers is currently not highlighted in Introduction or subsequent sections of the SPM. Please consider to reference this important function and the substantial number of people affected. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6234	SPM	2	26	2	32	This whole paragraph seems to downplay the number at risk from the changes in the oceans and cryosphere, focusing only on those at most direct risk without indicating how what happens in the polar regions, for example, affects people (e.g., less sea ice affecting the weather that affects mid-latitudes). Essentially, the whole global population depends on the polar regions being cold and the glacial ice not all melting, etc. When the world was last at 4°C or so above pre-industrial, the Greenland ice sheet was not present and the Antarctic ice sheet was much smaller, implying sea level was perhaps 50m higher than present. It may take a while to get there, but that would seem to be what is at risk, and this needs to be explained to reader. [Government of United States of America]
7762	SPM	2	27			Start-up box: there is statement without reference. It states : "Today, around 4 million people live permanently in the Artic region, of whom 10% are Indigenous". This figure should be double-checked and, if correct, properly referenced. [European Union]
6236	SPM	2	27	2	28	This estimate seems a lower bound. Looking at <https://www.arcticcentre.org/EN/arcticregion/Arctic-Indigenous-Peoples> it appears that the population in the regions of the high north that will be seriously impacted may well be 13 million. [Government of United States of America]
8596	SPM	2	27	2	28	Arctic polulation is 4 million, no projection in 2050. low lying coastal zone population around 680 million, projected population of 1 billion by 2050. line 30 to line 31, increase is 0.68. high mountain region population around 670 million and projected population between 740 to 840 by 2050 (increase 0.25). Why the increase are so different? [Government of Kiribati]
7560	SPM	2	27	2	31	World population figures here are from 2010 while in SPM.1 b) there seem to be more recent figures. Consistency and most recent possible figures should be used. [Government of Finland]
6238	SPM	2	28	2	28	Replace "of whom 10% are Indigenous" with "including an Indigenous population of approximately 400,000 people, who are vulnerable to the vast cryospheric changes occurring in the region." Also consider including a definition of Indigenous here (could be included as a footnote or within a Key Terms box). [Government of United States of America]
6240	SPM	2	28	2	28	Consider rephrasing to "Low-lying coastal zones situated around the globe are currently home to …" [Government of United States of America]
6242	SPM	2	28	2	30	The base population seems off. The World Bank has 6.923B in 2010, hence 11% and 10% of the base do not agree with the values in the text: <https://data.worldbank.org/indicator/sp.pop.totl>. [Government of United States of America]
6244	SPM	2	28	2	31	With nearly three-quarters of the world's 20 largest cities located on coastlines and vast areas of populated coastal beach areas and lowlands, it seems very implausible that there are virtually the same number of people at risk in the low-lying coastal zone, deltas, and along rivers that reach inland at near sea level (less than 10 meters above sea level) as in high mountain regions. The message has long been that the coastal areas are quite highly populated and at unusually significant risk, yet the statements here suggest the 10% in coastal regions are not especially significant center of the global population. In addition, given international trade, the dependence on economic activities in coastal regions is far larger. Another way to make clear the issue of those at risk at low elevations would be to give mention to the number of island nations that have more than half their land at less than 10 meter elevation -- quite a number have the potential to be inundated with sea-level rise projected in the next one to two centuries. [Government of United States of America]
6246	SPM	2	29	2	29	Insert "and is" before projected. [Government of United States of America]
6248	SPM	2	29	2	29	There must be a better population number for coastal residents than 2010. [Government of United States of America]
1026	SPM	2	29	2	30	Suggest using a less dated statistic for global population. Current reference is from 2010. [Government of Australia]
6250	SPM	2	30	2	32	It would also be useful to indicate the number of those dependent on glacial runoff. It is a number far above the number of those living in high mountain regions. [Government of United States of America]
6252	SPM	2	32	2	32	Bring it home for readers: 1.354billion people are directly impacted where they live now and 1.844billion projected -- that is, 18% of the population directly impacted. [Government of United States of America]
2598	SPM	2	33	3	1	The findings that emissions to date commit us to 'changes over decades to centuries that cannot be avoided, thresholds of abrupt change and irreversibility' is one of the key messages of the report, but does not come across strongly in section B (projected changes and risks). This should be elevated to a headline message one of the main sections of the SPM - this could go in a new section A which brings together some of the key overarching messages, or could go at the top of the current section B, as one of the key messages about projected changes, and should be backed up by some concrete examples. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2604	SPM	2	33	3	1	Suggest this sentence is rephrased for clarity, for example, "The ocean and cryosphere has and is continuing to experience human-induced change, with further changes expected over the course of this century and beyond. Some changes are already unavoidable and will last decades to centuries, others may happen abruptly as critical thresholds are crossed or be irreversible ." [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4730	SPM	2	33	3	1	System inertia, lock in of long term change and threshold behaviour: As highlighted in our comments to the start-up box and general narrative, we miss clear framing of the committed change and system inertia that is specific to the Cryosphere and the Ocean. The lock-in of future impacts by current emissions should be highlighted in the start-up box, but also made clear in the headline statements. Suitable text sources would be, for example, CH1 p 4 3rd para: "Characteristics of ocean and cryosphere change include thresholds of abrupt change, long-term changes that cannot be avoided, and irreversibility (high confidence). Ocean warming, acidification and deoxygenation, ice sheet and glacier mass loss, and permafrost degradation are expected to be irreversible on timescales relevant to human societies and ecosystems. Long response times of decades to millennia mean that the ocean and cryosphere are committed to long-term change even after atmospheric greenhouse gas concentrations and radiative forcing stabilise (high confidence). Ice melt or the thawing of permafrost involve thresholds (state changes) that allow for abrupt, nonlinear responses to ongoing climate warming (high confidence). These characteristics of ocean and cryosphere change pose risks and challenges to adaptation." CH1 p 11, Section 1.3 "It takes hundreds of years to millennia for the entire deep ocean to turn over (Matsumoto, 2007; Gebbie and Huybers, 2012), while renewal of the large ice sheets requires many thousands of years (Huybrechts and de Wolde, 1999). Long response times mean that the deep ocean and the large ice-sheets tend to lag behind in their response to the rapidly changing climate at Earth's surface, and that they will continue to change even after radiative forcing stabilises (e.g., Golledge et al., 2015; Figure 1.1a). Such 'committed' changes mean that some ocean and cryosphere changes are essentially irreversible on timescales relevant to human societies (decades to centuries), even in the presence of immediate action to limit further global warming (e.g., Section 4.2.3.5). While some aspects of the ocean and cryosphere might respond in a linear (i.e., directly proportional) manner to a perturbation by some external forcing, this may change fundamentally when critical thresholds are reached. A very important example for such a threshold is the transition from frozen water to liquid water at around 0°C that can lead to rapid acceleration of ice melt or permafrost thaw (e.g., Abram et al., 2013; Trusel et al., 2018). Such thresholds often act as tipping points, as they are associated with rapid and abrupt changes even when the underlying forcing changes gradually (Figure 1.1a, 1.1c). Tipping elements include, for example, the collapse of the ocean's large-scale overturning circulation in the Atlantic (Section 6.7), or the collapse of the West Antarctic Ice Sheet though a process called marine ice sheet instability (Cross- Chapter Box 8 in Chapter 3; Lenton et al., 2008). Potential ocean and cryosphere tipping elements form part of the scientific case for efforts to limit climate warming to well below 2°C (IPCC, 2018). [Government of Germany]
6254	SPM	2	33	3	1	This sentence is difficult to follow. Perhaps revise as follows: "The responses of the ocean and cryosphere to past and current human-induced greenhouse gas emissions include changes that cannot be avoided, crossing thresholds that will yield abrupt change, and systems that will be changed irreversibly." [Government of United States of America]
6256	SPM	2	33	3	1	This sentence has poor syntax. Consider changing to something more readable like: "The ocean and cryosphere will continue to change over decades to centuries due to current and past greenhouse gas emissions. These changes include ongoing warming, melting of ice, crossing thresholds of abrupt change, and irreversible changes." Mentioning some irreversible changes might be appropriate. [Government of United States of America]
7764	SPM	2	33	3	1	The sentence mentions important concepts, but it is a bit clumsy. "irreversibility" is not a "response" as such, but a characterestic of certain responses. Also, for the changes "that cannot be avoided" the term "committed change" could be introduced and consistently used throughout the report. [European Union]
6258	SPM	2	33	3	3	See the recent JCOMMS report card: <http://www.jcommops.org/reportcard2019/>. How much more CO2 can the ocean absorb and sustain marine life that depends on a food web of calcium carbonate-based shelled creatures? [Government of United States of America]
4190	SPM	2	33	3	5	We suggest that you also describe how the future changes in the ocean will be influenced by the level of climate change and future greenhouse gas emissions. As it is now, the text seems to focus only on the impacts that cannot be avoided. [Government of Norway]
7766	SPM	2	33	3	5	Startups Box: These lines should be placed at the start of the box in order to introduce the reader to the importance of having IPCC specifically look into ocean & cryosphere issues. [European Union]
6260	SPM	2	34	2	34	There should be more clarity for the reader in reference to "changes over decades to centuries". Is this referring to changes that have already occurred over previous decades (since the Industrial Revolution) or is this forward looking? This entire sentence needs rephrasing; perhaps split it in two. [Government of United States of America]
7410	SPM	2	34	3	1	"changes over decades to centuries that cannot be avoided, thresholds of abrupt change, and irreversibility" seems to be listed as the objectives of the verb "include". The word "changes" and "irreversibility" explain a change in status, while "thresholds" explains a point at which something starts. Therefore it might be better to exclude "thresholds" from the list, and mention it in another sentence such as "exceeding thresholds of…", if necessary. [Government of Japan]

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4626	SPM	3	0	12		In quite some parts, there is a tendency to describe the observed changes since the AR5 in a straightforward way of "accelerating, deepening, exacerbating, etc." in all directions. Although for a majority of conclusions this is indeed the fact, in some cases (see specific comments) the conclusions are controversial. It is worth mentioning that natural variability is not discussed at all (mentioned two times in a minor context), leaving policymakers with questions as to, e.g., what was the global warming hiatus and may it happen again (it has been quite a progress in understanding this anomaly since 2013), or what contributed to the recent sea ice loss in the Arctc if only about 50% of it is attributed to anthropogenic global warming (A2.3.), or should we expect a reduced NA hurricane activity as it goes well alone with AMO that is assume to be in negative phase soon? [Government of Russian Federation]
4732	SPM	3	1	3	1	While the aspect of "irreversibility" is mentioned here, the surrounding text does not explain what these are or why they are important. A short explanatory statement on "tipping points" should be added, including a list of the tipping elements of the Cryosphere (e.g. the Greenland Ice Sheet, both of the Antarctic Ice Sheets, the Yedoma Permafrost) and of the oceans (e.g. ENSO and AMOC). [Government of Germany]
524	SPM	3	1	3	3	It should be mentioned how urgent is the need of action for policy makers and the level of mobilization (local and global). Please rephrase as "... change is needed urgently, in addition to..." [Government of France]
526	SPM	3	1	3	3	Term 'greenhouse' mitigation is unclear, either a word is missing, either just 'mitigation' should be used. [Government of France]
2600	SPM	3	1	3	3	"This implies that...in addition to greenhouse mitigation" - this currently sounds like greenhouse gas mitigation is treated as an afterthought, and that the focus should be on adaptation. To emphasise the importance of both, suggest this could be rephrased as: "This implies that, in order to manage risks, adaptation of ecosystems and societies to ocean and cryosphere change is needed, while greenhouse gas mitigation is essential avoid escalating risks" [Government of United Kingdom (of Great Britain and Northern Ireland)]
6262	SPM	3	1	3	3	The wording of this statement makes GHG mitigation policy-prescriptive. This can be remedied by revising the sentence to "Adaptation of ecosystems and societies to oceans and cryosphere change, as well as greenhouse gas mitigation, can help manage risks and avoid escalating risks." [Government of United States of America]
6264	SPM	3	2	3	2	"adaptation of ecosystems and societies to ocean and cryosphere change is needed": There should be some qualifier here that clarifies that not all ecosystems/societies will be able to fully or even partially adapt. Also this phrasing sounds like ecosystems have the ability to decide to adapt. Even adaptations strategies still often lessen rather than fully mitigate negative impacts. This sentence is obtuse as currently written. [Government of United States of America]
7692	SPM	3	2	3	2	add "gases" after "greenhouse" and before "mitigation" [Government of Spain]
8284	SPM	3	2	3	2	Insert "gas" after "greenhouse" at the end of the line. [Government of New Zealand]
3420	SPM	3	2	3	3	Suggest changing "greenhouse mitigation" to "climate change mitigation". [Government of Sweden]
6266	SPM	3	2	3	3	Missing "gas" (says "greenhouse mitigation"). [Government of United States of America]
3682	SPM	3	2	3	5	Given the role of the oceans as a sink for CO2 in achievement of the UNFCCC, GHG stablisation and Paris Agreement balance of GHG emissions and removals as well as the fact this unmanaged but susceptible to climate change. [Government of Ireland]
6268	SPM	3	3	3	3	Replace 'interacts with' with either 'affects' or 'impacts'. The ocean and cryopshere are not interacting with SDGs. [Government of United States of America]
4274	SPM	3	3	3	4	Correct that the state of ocean and cryosphere interacts with a number of SDG (1, 2, 3, 5, 6, 12 ...): Suggest to add a clear reference to SDG14. Suggest to also refer to Aichi Target in the introduction, especially before IUCN 2020. [Government of Monaco]
528	SPM	3	3	3	5	Why single out one SDG ? [Government of France]
1318	SPM	3	3	3	5	We appreciate to put this report in the context of the UN Sustainable Development Goals. However all of the Goals seem equally important, so we would prefer not single out one specific goal (poverty reduction). [Government of Luxembourg]
3684	SPM	3	3	3	5	Refer to the UNFCCC and Paris Agreement as well as SDGs [Government of Ireland]
7768	SPM	3	3	3	5	Add in "... making the future of the ocean and cryosphere a worldwide social, environmental and economic concern". Justification: Sustainability as described in SDG and referred to in the earlier introductory text is covering social, environmental and economic aspects, even if this sentence seems to highlight social concern, which would be an omission [European Union]
7770	SPM	3	3	3	5	The sentence on how ocean and cryosphere interacts with all SDGs could fit better at the end of the 2nd paragraph (lines 22-25, page 2), which is addressing the social and economic value on ocean and cryosphere. Moving it there would also leave the last paragraph with the strong conclusion on the need for adaptation" [European Union]
3422	SPM	3	4	3	4	Poverty reduction is very important within the SDGs, but it is not clear why it is specifically mentioned here. [Government of Sweden]

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4740	SPM	3	4	3	4	Suggest to delete "including poverty reduction" - it is unclear why poverty is given as an example here, since poverty is not in the focus of the given report. [Government of Germany]
530	SPM	3	5	3	5	Please consider adding the economic concern too. "...social and economical concerns." [Government of France]
4276	SPM	3	7	3	7	"Sea level rise and coasts" should be replace by "Coastal areas". The "Sea level rise" is an consequence of the climate change. It does not correspond to a geographical location, as others legends do. [Government of Monaco]
4278	SPM	3	7	3	7	Changing the symbol of the ocean leading to confusion with impacts on corals. [Government of Monaco]
7694	SPM	3	7	3	7	the symbols are useful, but the third one should only be called "coasts". They all refer to ecosystems, and this one is referring to an ecosystem and one specific impact of climate change on that ecosystem. We want this symbol to be named "coasts" to be consistent with the others. [Government of Spain]
532	SPM	3	7	3	8	Legend for sections: Please consider replacing "Sea level rise and coasts" by "Sea level rise and coastal areas". [Government of France]
4076	SPM	3	7	3	8	The figures used in the legends of each section (to denote which of the report's temes the paragraph covers) were useful for navigating the document. Please retain these. [Government of Norway]
4718	SPM	3	7	3	8	Legend for Sections: The added icons may be useful in guiding policy makers, though we don't see much added value because the relevant text themes are easy to identify even without this additional legend. Also, it seems that currently, the icons follow the chapter structure rather than the content (i.e. they depict in which chapter these issues can be found), however this information could also easily be gleaned from the line of sight provided in brackets after each statement. To increase value added, icons would have to pertain to content and possibly be more differentiated (e.g. coastal ecosystems, extremes...). This, again, may create debate about which icon needs to be on which section, and the likely result of having additional icons on each section would decrease usability. We don't have strong views on the icons/legend - except for the space requirements which could be accommodated by shrinking them a bit. However we'd caution that their introduction might add another challenge in terms of time needed for government approval. If kept, we would prefer blue icons, since ocean and ice tend to be blue rather than green which seems more suitable for the vegetation. [Government of Germany]
5984	SPM	3	7	3	8	This SPM classified 4 legends for sections. However, there is 5 chapters in the SROCC, excluding introduction, in total and the contents of each chapters are also different. Therefore it is resonable to classify the five legends of sections in this SPM. [Government of Republic of Korea]
8286	SPM	3	7	3	8	The use of these icons is a great innovation. Consider including one sentence with this legend, toexplain how they are used. [Government of New Zealand]
4738	SPM	3	11	12	44	Whole section A5 talks already about impacts on people / fisheries, yet impacts on people supposed to only starting from A7; please revise to make sections consistent with structure; please also see comment on p8 ln 11. [Government of Germany]
4280	SPM	3	11	3	11	It would be most helpful to summerize all the different findings by an introductive map representing causal relations Figure TS.2. [Government of Monaco]
6270	SPM	3	11	3	13	The section needs to also include the impacts on the weather of not just the region, but on the weather of mid-latitudes. More generally, the implications for not just the region, but for the international community of nations need to be indicated, and the points in this section simply do not do this. Figure SPM.2 includes indications that there will be changes, but there also needs to be text making very clear that change in the polar regions are having very important global implications. [Government of United States of America]
6272	SPM	3	11	5	13	Regarding seasonal warming in the Arctic, papers like Liston and Heimstra (2011) do highlight some regions with increasing snow depth, which leads to the potential for slightly longer duration in the spring. General comments have also been submitted about the tendency to treat the Arctic in terms of single responses. [Government of United States of America]
6274	SPM	3	11	5	13	The A1 section on cryospheric mass loss reflects World Glacier Monitoring Service reports and a recent synthesis by Huss et al. [Government of United States of America]
534	SPM	3	15	3	15	Please add "due to climate change in recent decades" after "is shrinking". [Government of France]
6276	SPM	3	15	3	15	"mass loss" shouldn't be hyphenated. [Government of United States of America]
1168	SPM	3	15	3	16	Since the changing cryosphere differs spatially on the earth (e.g. stabilized or advancing glaciers are found both in the Pamir region of the western Qinghai-Tibet Plateau and parts of Antarctica), it is suggested that "shrinking" be replaced with "generally shrinking". At the same time, in order to improve the textual accuracy of the report, it is suggested that "mass-loss" be changed to "negative mass balance". [Government of China]

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Comment id	Chapter	From page	From line	To page	To line	Comment
1320	SPM	3	15	3	17	We would suggest to put here some key figures for mass-loss from glaciers and ice sheets (711 Gt yr-1) and 800,000 km2 of snow cover lost per °C warming. [Government of Luxembourg]
2606	SPM	3	15	3	17	Can the physical changes in section A1 all be attributed to human-induced warming? If so suggest that this point it elevated and included in the headline A1 statement. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3106	SPM	3	15	3	17	The data to support this headline statement are from historical observations therefore the past tense should be used here to describe the changes: has shrunk vs is shrinking. [Government of Canada]
3424	SPM	3	15	3	17	The underlying report does not treat sea ice under "Ocean", but rather as a part of the Cryosphere. This suggests that Section A.1 should be made to be about the Cryosphere, not "only" the Terrestrial Cryosphere. This would entail moving A2.3-A2.4 from page 5-6 here. This would be more in line with general delineation of the systems, and in line with the underlying report (e.g. CHapter 1 defines sea ice as part of the Cryosphere, 1.2.2. inherently separares between the Ocean and the Cryosphere, as do 1.4.1-1.4.2). [Government of Sweden]
3686	SPM	3	15	3	17	Can be stronger; include data on extent and rate of change and period being considered [Government of Ireland]
4100	SPM	3	15	3	17	Please consider adding a key finding on temperature increase in the shaded text, since this change is the driver of many other changes following in the text, for instance using parts of A2.4 in the A1 statement. [Government of Norway]
4102	SPM	3	15	3	17	Please consider also including the total contribution to sea level rise from Greenland ice sheet, Antarctic ice sheet and glaciers either in the shaded text in A.1 or in the text A1.1. [Government of Norway]
4742	SPM	3	15	3	17	We suggest to include a reference to the basis for the statements (text complement in bold); alternatively could this text (bold) be placed after p. 3, line 13 and before line 15: Earth's terrestrial cryosphere is shrinking, through mass-loss from glaciers and ice sheets (very high confidence), reduced seasonal snow (high confidence), and degradation of permafrost (high confidence). Scientific basis of this results are ocean and cryosphere observations, remote sensing data, model calculation and other sources. {1.8.1, 2.2, 2.3, 3.3, 3.4, Figures SPM.1, SPM.2} [Government of Germany]
6038	SPM	3	15	3	17	Despite the fact that polar ice is melting, there is no evidence that this is a resultant of human induced GHG emissions [Government of Saudi Arabia]
4744	SPM	3	15	7	17	Structure A1/A3: Similar to Section B1/B3, there's some redundancy between section A1 and A3 which both describe (accelerating) rates of ice mass loss. The same as in B3 also occurs in A3 with regard to extreme sea levels, wave heights and other observed extremes. For a more clear and less redundant partitioning between section A1 and A3, we'd suggest to start this section with what is currently A3.4 (p6 ln 51 to p 7 ln 2), adding a line that references accelerating melt/increase thermal expansion without giving detailed numbers; then move current A3.5 to the end, and add the lines on extreme sea levels from A3.4 (p 7 ln 2-4) as starting lines to A3.6. So the structure would be A3.1 GMSL rise (current A3.4 minus extreme), A3.2 extreme sea levels, other observed effects from cyclones, extreme waves, A3.3 SLR is not uniform and depends on different factors. It makes sense to organize the section into a part that deals with mean sea level rise, and one that addresses extreme sea levels and other observations for related extremes (such as storms, precipitation…), and include both in the headline statement. To highlight the importance of accelerating melt rates and give room to the question whether we are already observing the onset of irreversible retreat in WAIS, a standalone section could be drafted based on current A3.1 and A3.2, and potentially additional information on observations of increasing melt rates in mountain glaciers. Current A3.3 (ocean heat content) should be integrated into A.2. If the authors decide not to include such a separate section, we'd still recommend to move current A3.4 to the front, and concentrate the information on extremes in the same subsection, and move information about accelerated rates to A1, so the reader does not have to go to 2 different places to find information on observed melt (rates) of Ice Sheets. [Government of Germany]
7772	SPM	3	16			Can the degradation of the permafrost not be stated with a higher ("very high") confidence? [European Union]
6278	SPM	3	16	3	16	KEY ISSUE [CONFIDENCE]: Why is the reduced seasonal snowfall only 'high confidence'? It seems that this would be 'very high confidence'. [Government of United States of America]
6280	SPM	3	16	3	16	KEY ISSUE [CONFIDENCE]: Suggesting reductions in snow cover and degradation of permafrost are only of "high confidence" seems a serious understatement. On the permafrost issue, page 3, line 43 says "very high confidence" with respect to the temperature increase since 1980. [Government of United States of America]
1170	SPM	3	16	3	17	Warming leads to an increase in ocean evaporation. Although snowfall varies from region to region, the overall picture is that snowfall in cold regions increases, while snow cover decreases in extent and shortens in duration. It is suggested that "reduced seasonal snow" be replaced with "reduced snow cover". [Government of China]
3688	SPM	3	18	3	19	Can a statement on the temporal and spatial extent of observational data be provided as context for later statements [Government of Ireland]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7696	SPM	3	18	3	48	we reiterate our comment of maximizing the use of tables for figures, uncertainty ranges, units, periods of time, intervals of GC,… Text should be easier to read, there are paragraphs that are hard to read even for scientists. Policy makers won't look at them. [Government of Spain]
3108	SPM	3	19	3	19	The data to support this result are from historical observations therefore the past tense should be used here to describe the changes: change “are losing” to “have lost”. [Government of Canada]
6282	SPM	3	19	3	19	Should be 'between' instead of 'in'. [Government of United States of America]
4746	SPM	3	19	3	21	Please provide an estimate of the fraction of total ice mass lost of each sheet in these 10 years, if possible. This would help the reader understand the significance and dimension of loss. [Government of Germany]
536	SPM	3	19	3	26	It would be better to keep the same calling order for the 2 ice-sheets in the 2 parts of the paragraphe [Government of France]
1172	SPM	3	19	3	26	A substantial proportion of the underlying report is devoted to a comprehensive assessment of glacial changes in high mountain areas. However, the core findings and messages in this respect are not fully reflected in SPM A1. It is suggested that the latest relevant assessments be added as found in the underlying report. [Government of China]
2608	SPM	3	19	3	26	Can the rates of ice sheet and glacier mass loss include the % loss of total mass (if available)? This would be easier for a policy audience to understand. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6040	SPM	3	19	3	26	I think glaciers and ice melting is going to reduce the deep ocean's temperature and definitely is going to improve the marine ecosystem (this is an area where true analysis is required) [Government of Saudi Arabia]
6284	SPM	3	19	3	26	With the contributions of the WAIS and glaciers each being 0.77m, there is the potential for misinterpretation. Add the total contribution from land ice at 1.54 mm/yr during 2006-2015. [Government of United States of America]
7412	SPM	3	19	3	26	It would seem more reader-friendly if the figures provided in this paragraph are compared to those in Section B.4 of AR5's WG1 SPM, as it seems that that sea level rise due to glaciers loss is almost the same, while that due to ice sheet loss has increased in comparison to those in AR5. [Government of Japan]
7774	SPM	3	19	3	26	A1.1: It is not clear how these numbers represent an evolution from observations in SR 1.5/AR5, what is the difference, and what is the total added corresponding sea-level contribution from ice sheets and glaciers combined during this period? This needs to be clearly highlighted at the end. [European Union]
7776	SPM	3	19	3	26	A1.1 Why not supply a single consolidated figure for global sea level rise from both ice sheets and glaciers? See general comment about re-ordering A&B statements A1.1, A3, B1.1 and B3 tell a coherent story about sea level rise. They should be placed together. [European Union]
4126	SPM	3	19	3	27	Please indicate how the loss rate has increased (See AR5 WGI SPM where it is stated that "There is very high confidence that the Greenland Ice Sheet has lost mass during the last two decades. The average rate of mass loss has very likely increased from 34 [−6 to 74] Gt yr–1 over the period 1992–2 2001 to 215 [157 to 274] Gt yr–1 over the period 2002–2011. {4.4.2, 4.4.3}"). [Government of Norway]
3690	SPM	3	19	3	40	Can context for number be provided e.g. change relative to earlier decades [Government of Ireland]
3790	SPM	3	19	3	47	Can data on the level of CO2 or additional CO2 being held or taken up by the oceans be included? This would be useful data for climate policy [Government of Ireland]
7778	SPM	3	20			The first appearance of "Gt yr-1" should be resolved as "(Gigatonnes per annum)" and not Gigatonnes yr-1, which is basically how it is abbreviated. [European Union]
6286	SPM	3	20	3	20	"the Greenland Ice Sheet lost ice mass at a rate of 278 ± 11 Gigatonnes yr-1 (Gt yr-1)": Is it possible to also include what fraction of the entire Greenland Ice Sheet this mass measurement represents, either per year or over the 2006-2015 reference period? This number is hard for most people to grasp and a percentage might have more of an impact. Consider doing this throughout the chapter. [Government of United States of America]
8376	SPM	3	21	3	21	"These correspond…" [Government of New Zealand]
3110	SPM	3	21	3	22	Re-word to make clearer that the numbers refer to two separate sea level rise contributions for the ice mass losses stated in the previous sentence. Suggested re-wording: These losses correspond to global sea level rise contributions of 0.77 ± 0.03 and 0.43 ± 0.05 mm yr-1, respectively. [Government of Canada]
4748	SPM	3	21	3	22	Please provide also the total SLR since pre-industrial times. [Government of Germany]
6288	SPM	3	21	3	22	Definitively indicate which figure is associated with which ice mass -- assuming 0.77 from Greenland and 0.43 from Antarctica. Also consider including "… and an estimated XX increase in sea level rise over the 2006-2015 observation period." [Government of United States of America]
7414	SPM	3	21	3	22	SPM describes that Greenland and Antarctic ice sheets have raised the sea level by 0.77 ± 0.03 and 0.43 ± 0.05 mm yr-1 on global average by melting the ice sheet, but in Table 4.1 of Chapter 4, the figures are 0.77 (0.72 to 0.82) and 0.43 (0.34 to 0.52), respectively. [Government of Japan]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6290	SPM	3	21	3	25	What do the sea level rise contribution numbers given here mean in the context of overall sea level rise? What are the physical consequences of these metrics? The figures later in the report are helpful, but more context may be needed here. [Government of United States of America]
1408	SPM	3	21	3	26	Section on contibution to SLR could be moved to A3.1. The figures on contributions to SLR here confuses the picture. [Government of Denmark]
7780	SPM	3	22			Insert ", respectively" to read "... 0.03 and 0.43 +/- 0.05 mm yr-1, respectively." [European Union]
2612	SPM	3	22	3	22	Suggestion to add '...0.03 and 0.43+/- 0.05mm yr-1 'respectively.' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6292	SPM	3	22	3	22	Add 'respectively' at the end of the sentence -- i.e., "...0.03 and 0.43 +/- 0.05 mm/yr, respectively." [Government of United States of America]
1174	SPM	3	22	3	23	In order to improve the textual accuracy, it is suggested to replace "Ice loss from Antarctica" with "Ice sheet loss from Antarctic ice sheet". At the same time, the sentence "Ice loss from Antarctica is dominated by the rapid thinning and retreat of major glaciers draining the West Antarctic Ice Sheet" is inconsistent in formulation with the corresponding one in Chapter 3 on page 5 of the underlying report, which reads: "Antarctic ice loss is dominated by acceleration, retreat and rapid thinning of major West Antarctic Ice Sheet outlet glaciers, driven by melting of ice shelves by warm ocean waters". "outlet glaciers" are part of "ice sheet", whereas glaciers are not. It is suggested that the relevant expressions be checked and revised. [Government of China]
8176	SPM	3	22	3	23	The use of "major glaciers" is confusing and not appropriate for Antarctica. It can be revised as "major outlet glaciers" instead. [Government of India]
1028	SPM	3	22	3	24	Suggest swapping the sentences dealing with Antarctica and Arctic around - to be consistent with the order of the previous few sentences. [Government of Australia]
6294	SPM	3	22	3	24	Consider describing Greeland mass loss before Antarctic mass loss since this is the order described in the introductory sentence. [Government of United States of America]
4750	SPM	3	23	3	24	In the statement "Greenland has been dominated.. by surface melting.", the time period is missing. We suggest to replace/extend this statement by the following lines from the executive summary of Chapter 3. "Summer melting of the Greenland Ice Sheet has increased since the 1990s (very high confidence) to a level unprecedented over at least the last 350 years, and two-to-fivefold the pre-industrial level (medium confidence)". This would help to better represent material in 3.3.1.4 and Figure 3.7 in the SPM, and highlight accelerating rates of melting. [Government of Germany]
7782	SPM	3	24			what is meant here by “high levels”? This feels somewhat arbitrary. [European Union]
4282	SPM	3	24	3	24	Confusion: the glaciers worldwide that are not part of the ice sheets. [Government of Monaco]
5990	SPM	3	24	3	24	Glaciers -> Mountain Claciers? Specify it to avoid confusion. [Government of Republic of Korea]
6296	SPM	3	25	3	25	Interesting that the glacier mass loss rate and sea level contribution are almost identical to that of the Greenland Ice Sheet. Is there a relation between these numbers or is this pure coincidence? [Government of United States of America]
6298	SPM	3	25	3	25	Is two decimal places (mm/yr) overly granular? [Government of United States of America]
4752	SPM	3	25	3	26	It cannot be traced where the numbers for the retreat of the glaciers originate. The range appears very large. Changes in the glaciers are also described in Chapter 3.3.2 of the SROCC, this source is missing. Please makes sure that the numbers provided and traceable account is correct. [Government of Germany]
4754	SPM	3	28			Does this mean that 13,4 % / decade has been lost in these 50 year, i.e. the extent is almost 70 % less than in the late 1960-ies? Please provide this number as well. This would help the reader understand the significance and dimension of loss. [Government of Germany]
1464	SPM	3	28	3	28	Please specify if the figure given refers to 'terrestrial snow' only, or if it also includes snow on sea ice. [Government of Italy]
7416	SPM	3	28	3	28	A1.2 reports that Arctic June snow cover extent declined by 13.4 ± 5.4% per decade between 1967 and 2018, but the relevant chapter refers to this period as 1981 to 2018 instead of 1967 to 2018. It is better to be consistent. [Government of Japan]
8378	SPM	3	28	3	28	Sometimes (as in this line) changes are expressed in % per decade. In other places (eg A1.3) they are expressed as % change over the full observation interval. If possible, consistency would be helpful. [Government of New Zealand]
3112	SPM	3	28	3	33	The icons show this comment to apply to the mountain and polar cryosphere, but seems that the quoted rate of decline in the extent of snow cover in June is compiled for terrestrial environments and does not include snow on ice. If so, recommend that this be made clear. It would also be useful to say why this particular metric (“extent in June”) was selected. [Government of Canada]
4174	SPM	3	28	3	33	Please consider explaining briefly why "Arctic June snow extent" is mentioned (albedo and positive feedback when sun radiation is strongest, increased growth season of vegetation) and not for example November. Please also consider mentioning that max snow extent during winter has not changed and explain why. [Government of Norway]
4176	SPM	3	28	3	33	Please consider adding information on regional differences, but that all spring snow cover duration trends from all datasets are negative (SROCC 3.4.1.1). [Government of Norway]

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4628	SPM	3	28	3	33	There is no doubt in accelerating decrease of snow cover extent in summer. But there is obviously an increase of snow depth (SWE) in vast regions of Nortern Eurasia (e.g., Bulygina et al., 2011, ERL). One simply cannot expect the opposite since winter precipitation steadily increases over sub-Arctic N. Eurasia (and over northern high latitude in general), what is a robust signal of global warming well reproduced by all climate models.This tendency wouldn't got reversed on a for the last few years. In the next par.A1.3, it is reported that Eurasia river discharge is increased. But this discharge at basically controlled by accumulated winter precipittaion (snow melt). Furthermore, the snow extent in Eurasia did not decrease in October, when there was a strong positive trend until the beginning of the 21st century (Cohen et al., 2012). Since 2005 the trend become negative but this did not reverese the long-term tendency, which, at most, can be chatacterized as no significant change. [Government of Russian Federation]
6042	SPM	3	28	3	33	With the lost of 800,000 Km2 of snow and melted into the oceans, how much the sea-level rise in the last 50 years? and what was the average temperature arose? finding this correlation will give an accurate indication for oceans' status at least until mid-century. [Government of Saudi Arabia]
2620	SPM	3	29	3	29	Will policymakers know what extratropical means? Suggest an alternative if possible. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4182	SPM	3	29	3	29	Please consider simplifying language by avoidig the word "extratropical" by e.g writing .."attributed to temperature increases outside the tropical regions" [Government of Norway]
4756	SPM	3	29	3	29	pls. insert: …cover extent and duration… (p. 3-58) [Government of Germany]
6300	SPM	3	29	3	29	Define extratropical temperature increases either in the text or as a footnote. [Government of United States of America]
538	SPM	3	29	3	30	Please rephrase this sentence as it is not clear to which "°C warming" it refers to : extratropical one? global warming? arctic warming? If it is Arctic warming, please consider making two sentences for more readibility, rephrasing for example as : "Reductions in snow cover duration are directly attributed to extratropical temperature increases (high confidence). Approximately 800,000 km2 of snow cover is lost per 1°C warming in the Arctic in both autumn and spring (high confidence)." See chapter 3 p.3-58 : "Changes in Arctic snow extent can be directly related to extratropical temperature increases (Brutel-Vuilmet et al., 2013; Thackeray et al., 2016; Mudryk et al., 2017). Based on multiple historical datasets, there is a consistent temperature sensitivity for Arctic snow extent, with approximately 800,000 km2 of snow cover lost per °C warming in spring (Brown and Derksen, 2013; Brown et al., 2017), and 700,000 to 800,000 km2 lost in autumn" [Government of France]
2626	SPM	3	29	3	30	Suggest to replace "temperature increases" with "warming" (for improved readability, and to match the language later in the sentence). [Government of United Kingdom (of Great Britain and Northern Ireland)]
8380	SPM	3	29	3	31	Unclear whether this relation ship is per degree of global warming, or local to the snowcover location. [Government of New Zealand]
8608	SPM	3	30	3	30	Is this local or global temperature increase? [Government of Netherlands]
6302	SPM	3	30	3	31	Chapter 3 suggests the autumn losses are a range: 700,000 to 800,000 km2 lost in autumn (Derksen and Brown, 2012; Brown and Derksen, 2013) (high confidence). 3.4.1.1.3 [Government of United States of America]
540	SPM	3	31	3	32	Please consider revising this sentence at it seems unclear (either specify the difference between high and low elevation or specify that this number only stands for low elevation). Please consider introducing the average. We suggest rephrasing as "The depth, extent and duration of snow cover has declined in nearly all mountain regions (high confidence). At lower elevation, the mountain snow cover has generally declined on average by 5 snow cover days per decade, with a likely range from 0 to 10 days per decade (high confidence). At higher elevation, snow cover trends are generally insignificant (medium confidence) or unknown." [Government of France]
3114	SPM	3	31	3	32	Presumably, the likely range of 0-10 days per decade applies to changes in snow cover duration and not to snow depth and extent. Sentence is unclear as currently written. Suggest starting with the assessed likely change in snow cover duration, then add the additional info that depth and extent of snow cover have also declined. [Government of Canada]
6304	SPM	3	31	3	32	If snow cover has declined in nearly all regions, especially at lower elevations, it is confusing to say the lower range is "0" days per decade. The first-order draft did not give a range. Chapter 3 explains this somewhat by stating that "At higher elevation, snow cover trends are generally insignificant (medium confidence) or unknown." This point could be added to the SPM so that the reader understands why the lower range is "0". [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7784	SPM	3	31	3	33	The range provided to calculate decline in duration of snow cover is from 0 to 10 days per decade. Could we have also a decline for the whole period considered (presumably from 1967 to 2018, but it is not clear). Also, could the depth and/or extent of the observed loss also be quantified? The importance of '0-10 days per decade' is not obvious to a non-expert. [European Union]
8206	SPM	3	31	3	33	The rate of decline of arctic snow cover depth per decade should be provided along with the changes in extent and duration of snow cover. In fact, snow cover depth should be discussed a bit more in the report elaborately. [Government of India]
1030	SPM	3	32	3	32	Suggest replacing "range" with "duration" to make it explicit that the "0-10 days" refers to duration of snow cover. [Government of Australia]
4284	SPM	3	32	3	32	The depth and extend of snow-cover has declined, and the snow-cover duration is declining on average by 5 days per decade, with a likely range from 0 to 10 days per decade. [Government of Monaco]
6306	SPM	3	32	3	32	Does 0-10 days per decade refer to duration? Confusing to also include depth and extent in this sentence. Needs some clarifying. [Government of United States of America]
7786	SPM	3	32	3	32	"... especially at lower elevation": Please clarify what does it mean in concrete terms (< X m). The reference seems, however, evident (lower elevation logically always lead to shorter snow cover periods). [European Union]
8212	SPM	3	35	3	35	what are high mountain glaciers? Does this exclude high latitude low mountaiin glaciers? Where is the threshold? It would be better to clearly define "glaciers" as distinct from "ice sheets" at the very beginning and then only use "glaciers". [Government of Austria]
6044	SPM	3	35	3	36	what kind of changes? ambiguous conclusion. [Government of Saudi Arabia]
2610	SPM	3	35	3	40	It is unclear if the observations in this statement only reflect changes in the Northern Hemisphere or globally? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2622	SPM	3	35	3	40	A1.3 could state more clearly the consequences of some of these changes. For example, does annual discharge of rivers into oceans contribute to seas level rise, and does a change in the stability of high-mountain slopes mean an increased frequency of avalanches? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6308	SPM	3	35	3	40	This key message (A1.3) discusses the influence of glacier and snow melt on Arctic hydrology, including the increased discharge; however, it fails to address the impacts of the increased river discharge on the Arctic Ocean. Suggesting adding a sentence discussing this connection and impact. [Government of United States of America]
8434	SPM	3	35	3	40	We salute the mention of the changes in high mountain glaciers, but it should be noted that in general these changes involve a retreat or reduction, rather than generic "changes". [Government of Peru]
3118	SPM	3	36		37	The text here reports trends in runoff over the period of 1976-2018, but the underlying chapter cited here (Section 3.4.1.3.2) reports trends for a different period of 1976 to 2015. [Government of Canada]
542	SPM	3	36	3	36	Please add "of freshwater" after "discharge" in order to make a link to A.2.5 "high latitude freshening". We suggest to add a mention to freshwater discharge in A.2.5 [Government of France]
4758	SPM	3	36	3	36	pls. substitute 2018 by 2015 (p. 3-62) [Government of Germany]
1176	SPM	3	36	3	38	The sentence "From 1976 to 2018, annual discharge into the Arctic Ocean increased for large Eurasian and North American rivers by 3.1 + 2.0% and 2.6 + 1.7%, respectively (medium confidence)" is inconsistent with the finding in the underlying report (Executive Summary of Chapter 3, page 4), which reads "Runoff into the Arctic Ocean increased for Eurasian and North American rivers by 3.1 + 2.0% and 2.6 + 1.7%, respectively (medium confidence). North American rivers by 3.3 (+1.6%) and 2.0 (+1.8%) respectively (1976-2018; medium confidence)." It is suggested that relevant numbers be checked and revised. [Government of China]
3120	SPM	3	37			As written the text implies that runoff increased for each North American and each Eurasian river individually, but it is actually the total over each region which is assessed in the underlying chapter. Suggest writing 'annual discharge into the Arctic ocean from large Eurasian and North American rivers increased by 3.1 +/- 2% and 2.6 +/- 1.7%, respectively'. [Government of Canada]
3122	SPM	3	37		38	The first sentence says that changes in glaciers, snow melt and hydrology have caused changes in river runoff, and the second sentence reports observed increases in discharge into the Arctic ocean. The implication is that the observed increase in runoff is caused by anthropogenic climate change. But in the underlying chapter results, Figure 3.10 shows a simulated decrease in runoff into the Arctic ocean over the historical period in response to anthropogenic and natural forcings (lower right panel). If the observed increase in runoff into the Arctic were caused by anthropogenic climate change, then the processes responsible must not be well-represented in the models used to generate Figure 3.10, lower right panel. This deserves further comment. [Government of Canada]

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3426	SPM	3	37	3	37	The text could be misunderstood viz. whether the percentages are for total ~50 year change in annual discharge, or per-year changes in annual discharge over the period. Please clarify for easy reading. [Government of Sweden]
4760	SPM	3	37	3	37	pls. Ensure numbers given here are consistent with the numbers as given in the underlying chapter at p.3-62: 3.3 ± 1.6 % for Eurasian rivers and 2.0 ± 1.8 % for North American rivers. [Government of Germany]
7418	SPM	3	37	3	37	For the period from 1976 to 2018, it is reported that the Eurasian and North American rivers have been increasing by 3.1 ± 2.0% and 2.6 ± 1.7%, respectively, due to the inflow from the Arctic Ocean. However, the Executive Summary in Chapter 3 describes that Eurasian rivers have been increasing 3.3 ± 1.6% and North American rivers have been increasing 2.0 ± 1.8% for the same period. Also, in the main part of Chapter 3, the rate of change is the same as the executive summary in Chapter 3 but the period is different (the end of the period described in the main part of Chapter 3 is 2015). [Government of Japan]
6310	SPM	3	38	3	38	"Retreat of glaciers and thaw of permafrost have decreased the stability of high-mountain slopes…." What kind of impact does this have, and why should readers care about this? [Government of United States of America]
4526	SPM	3	39	3	39	The number and area (extent?) of glacier lakes 'from melt water' has increased... [Government of Belgium]
7788	SPM	3	39	3	39	The average area increase or number increase in glacier lakes could be included (perhaps for certain regions) to provide a more palpable image, like it's done for rivers in line 37. [European Union]
1178	SPM	3	39	3	40	It is suggested to supplement the findings of assessment of glacier lake outburst floods here. That is to add "with limited evidence of the frequency of glacier lake outburst floods has changed" after "The number and area of glacier lakes has increased in most regions in recent decades (high confidence)", which is supported by the Executive Summary of Chapter 2 on page 2 of the underlying report. [Government of China]
6312	SPM	3	39	3	40	As a result of increased glacial and snow melt? [Government of United States of America]
6314	SPM	3	42	3	42	Remove 'high' after 'increased to'. [Government of United States of America]
6316	SPM	3	42	3	42	"high levels THAT ARE unprecedented" … insert "that are" [Government of United States of America]
2628	SPM	3	42	3	43	Suggest to replace "increased to high levels unprecedented" with "increased to unprecedented levels" for improved readability. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4762	SPM	3	42	3	43	"Unprecedented in the observational record" seems like a strong expression in the context of the comparatively short and patchy observations for permafrost. Please consider to rephrase to sth. less sensational, like "highest levels since beginning of observations in the 1980s", or use formulation from ES. [Government of Germany]
1180	SPM	3	42	3	44	This sentence states that permafrost temperatures increased by 0.29℃ across polar and mountain regions from 2007 to 2016. However, no relevant information on this finding is available in Chapters 2 and 3 of the underlying report. It is suggested that the authors check and supplement the source of the finding. [Government of China]
3116	SPM	3	42	3	44	The value presented here for change in permafrost temperature globally over 2007-16 period comes directly from Biskaborn et al. 2019 paper which is cited in Ch. 2 and 3. However the global rate is never given in the text of the report (not in the sections mentioned - global rate in Ch2 Table is only for mountains). It might be useful to split into mountain and polar rates. Also, a rate over such a short period doesn't necessarily represent the long-term trend so it would be good to be more specific about the change since the 1980s (which is provided in Ch. 2 and 3) [Government of Canada]
6318	SPM	3	42	3	44	It would seem that a key aspect of increasing permafrost temperatures is whether these changes have resulted in above freezing temperatures. On average they have increased, and does that include increasing above freezing in some places? It would also seem that the average increase can be listed as an indicator, but need not be framed as an example. [Government of United States of America]
8460	SPM	3	42	3	44	To support the finding of an unprecedented increase in permafrsot temperature, the current increase needs to be compared to the earlier period in the observational record. [Government of Canada]
2618	SPM	3	42	3	47	I think this statement needs some context from the underlying text in Chapter 3 (3.4.3.1.1) to explain the cause for this uncertainty - "Observations such as these underlie the fact that source estimates for methane made from atmospheric observations are typically lower than methane source estimates made from upscaling of ground observations (e.g., Berchet et al., 2016), and this problem has not improved, even at the global scale, over several decades of research (Saunois et al., 2016; Crill and Thornton, 2017)." [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
2624	SPM	3	42	3	47	A1.4 currently does not clearly make the link that permafrost melt has the potential to significantly contribute to increased ghg emissions and further warming. While this is specifically addressed in section B.4 it may be helpful to rephrase this as "Permafrost region soils contain 1440-1600 Gt organic carbon, with the potential for some of this pool to be rapidly decayed and transferred to the atmosphere as CO2 and methane as permafrostthaws in a warming climate, thus accelerating the pace of climate change, although evidence is divergent to what extent this is currently occurring" (using text from page 3-60 of section 3..4.1.2.3 of the underlying report) [Government of United Kingdom (of Great Britain and Northern Ireland)]
3126	SPM	3	42	3	47	Paragraph is mainly about permafrost temperatures. SPM.1 panel (n) shows declines in near-surface permafrost extent, not changes in permafrost temperature. Readers would benefit if the link between these two indicators was explained, either here or in the figure caption, as warmer permafrost temperatures does not necessarily mean permafrost thaw (and loss of extent) will occur. [Government of Canada]
3128	SPM	3	42	3	47	The description of permafrost temperatures is misleading as currently written. The temperature metric would be better described in terms of depth and based on perhaps a few handfuls of locales. [Government of Canada]
3692	SPM	3	42	3	47	If unprecedented provide clear data on this feature [Government of Ireland]
4764	SPM	3	42	3	47	This para does not provide sufficient information about permafrost, given the potentially very high risk from permafrost thaw due to the release of GHG. - please describe the existing knowledge of potential GHG release from permafrost, even if evidence is divergent and confidence low - how much C, which GHG? - warming not homogenous vertically, thawing? - be more specific concerning the regions [Government of Germany]
6046	SPM	3	42	3	47	In this regard, the IMO has adopted the Polar Code, which deals with ships navigating in the polar regions. Also, the IMO through its MEPC adopted a resolution on banning the use of HFO as ships fuel while navigating that specific area, not that area as from January 2020, ships will only be allowed to use fuel oil with a sulphur limit 0.5% or less, or continue using 3.5% sulphur content provided that ships using scrubbers. [Government of Saudi Arabia]
544	SPM	3	43	3	44	Please check the consistency with chapters as other numbers are mentionned (see below). Moreover, it seems surprising that polar regions permafrost have the same warming trend as mountain regions permafrost. Please rephrase this example in order to make it accurate. Temperature over permafrost regions/domains could be clearer. Chap 2 p. 2-20 "A recent analysis finds that permafrost at 28 mountain locations in the European Alps, Scandinavia, Canada as well as High Mountain Asia and North Asia warmed on average by 0.19 ± 0.05 °C per decade between 2007 and 2016 (Biskaborn et al., 2019)." Chap 3, p.3-59 : "During the decade between 2007 and 2016, the rate of increase in permafrost temperatures was 0.39 ± 0.15°C for colder continuous zone permafrost monitoring sites and 0.20 ± 0.10°C for warmer discontinuous zone permafrost (Biskaborn et al., 2019)." [Government of France]
4766	SPM	3	43	3	44	pls. consider the different character of mountain and circumpolar permafrost by subdividing: Permafrost at 28 mountain locations warmed on average by 0.19 ± 0.05 °C per decade between 2007 and 2016. (p2-20). During the decade between 2007-2016, the rate of increase in permafrost temperatures was 0.39 ± 0.15°C for colder continuous Northern Hemisphere circumpolar permafrost and 0.20 ± 0.1°C for warmer discontinuous permafrost. (p. 3-59) [Government of Germany]
1020	SPM	3	44	25	6	Suggest adding a comma (,) between hundreds and thousands in numbers for clarity (e.g. - page 3, line 44 - 1,440-1,600, not "1400-1600"). Makes it clear this is not a year reference. [Government of Australia]
2614	SPM	3	44	3	44	2007 to 2016' do we only have observations of permafrost temperatures for this period? If available it would be good to know how much it has changed over the last 30 years. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3428	SPM	3	44	3	44	The "although" does not seem to make sense. Suggest its deletion and starting a new sentence. [Government of Sweden]
546	SPM	3	44	3	45	"Permafrost region soils contain 1440-1600 Gt organic carbon": As one may not be aware of what these numbers represent, we suggest to make a clear link with the atmospheric reservoir, rephrasing as : "High latitudes permafrost soils contain almost twice the carbon presently in the atmosphere (high confidence)" [Government of France]
1182	SPM	3	44	3	45	The Executive Summary of Chapter 3 on page 4 of the underlying report states that "Arctic and boreal permafrost region soils contain 1440-1600 Gt organic carbon (medium confidence)". It is suggested that "Arctic and boreal" be added before "Permafrost" in line 44 to maintain consistency with the finding in the underling report. [Government of China]
2616	SPM	3	44	3	45	1440-1600 Gt organic carbon' - how does this translate to emissions and existing atmospheric temperature/GHG concentration? It would make the numbers less abstract to a policymaker if we could translate it here. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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3124	SPM	3	44	3	45	This value for carbon is only for northern circumpolar permafrost region so you should probably say that here. You might also say that it is the best estimate. [Government of Canada]
4218	SPM	3	44	3	45	Please consider relating the organic carbon content in soils to the current carbon content in the atmosphere. [Government of Norway]
4220	SPM	3	44	3	45	In the underlying report the key finding on permafrost says that "permafrost temperatures has increased to record high levels", whilst SPM says "permafrost temperatures has increased to high levels". While understanding the need to avoid using terminology such as "record high", the sentence looks a bit ackward when "record [high]" is removed. Please consider keeping "record" or rewrite. [Government of Norway]
4768	SPM	3	44	3	45	The lower figure for the range of permafrost soil carbon content of in the SPM (of 1440 Gt OC) is not consistent with the figure in Chapter 3.4.1.2.3, being 1460 Gt. Please check and revise. [Government of Germany]
6320	SPM	3	44	3	45	KEY ISSUE [CONFIDENCE]: This is a strange way to use the confidence lexicon. What is well-established is that the Arctic permafrost areas contain very large amounts of carbon -- roughly double the amount in the atmosphere. The uncertainty is in the range about this rough total, not about whether there are large amounts of carbon in the permafrost areas. [Government of United States of America]
548	SPM	3	44	3	46	Please consider rephrasing "(medium confidence), although evidence is divergent " as "(medium confidence). Evidence is still divergent" [Government of France]
6322	SPM	3	44	3	47	It would help to specify which greenhouse gases may or may not be released into the atmosphere. Is it carbon dioxide alone, and/or methane, or others as well? [Government of United States of America]
7790	SPM	3	44	3	47	A1.4: Methane/permafrost comment. Isn't increased methane release well evidenced? Compare with Section B1.3 also in the SPM. The formulation of this sentence in page 3 would give the message that there are no emissions from permasfrost thawing – is this so? In addition, even if no additional emissions came from this, the already occurring impacts on communities (infrastructure damage for instance) and ecosystems should be highlighted here. SR1.5 suggested permafrost thawing could be a major contributor to feedbacks affecting the size of the carbon budget. Any elaboration on this knowledge from the underlying report should be included in the SPM. [European Union]
1410	SPM	3	44	4	44	Miss info on estimated global organic carbon in soils to scale the number. [Government of Denmark]
1032	SPM	3	45	3	45	Suggest replacing "evidence is divergent" with "there is no consensus". [Government of Australia]
1184	SPM	3	45	3	46	The increase in atmospheric greenhouse gases caused by permafrost warming has been confirmed by the vast majority of observations and simulations. This finding that "although evidence is divergent whether permafrost warming is currently causing the release of additional greenhouse gases to the atmosphere" is open to ambiguity and different interpretations. It is suggested to make it linguistically plain and unequivocal. [Government of China]
3430	SPM	3	45	3	46	A confidence statement would be needed here. While "evidence is divergent" suggests that confidence level is low, it does not really provide information on where the evidences points at (if anywhere). At the same time, but at the same time,"the release" would seem to imply that such release is observed. Please clarify, with confidence statements. [Government of Sweden]
6324	SPM	3	45	3	46	The issue is really about the net effect -- that is, whether or not regrowth of vegetation is compensating for the loss that is occurring. That soil carbon is degrading seems pretty likely. It is just if this additional amount is being taken up elsewhere. It would help to be clearer here. [Government of United States of America]
6326	SPM	3	45	3	46	It is good to see that the following statement has been added here: "evidence is divergent whether permafrost warming is currently causing the release of additional greenhouse gases to the atmosphere". This is an accurate reflection of the literature. [Government of United States of America]
1322	SPM	3	45	3	47	This statement seems to be in contradiction with paragraph B1.3, where projections shoe a clear release of greenhouse gases. [Government of Luxembourg]
8382	SPM	3	45	3	47	"evidence is divergent" is unclear. If referring to global assessments, then perhaps "there is no consensus". If referringto spatial variability, then say so. [Government of New Zealand]
1412	SPM	3	45	4	45	Although? The size of the pool dose not depend on wether it will be realeased or not. [Government of Denmark]
2630	SPM	4	0	4	0	SPM.1 - this figure includes only RCP 2.6 and 8.5 projections. While there is a need to not overcrowd this useful figure. these are not the most useful scenarios to be focusing on for a policy audience. Suggest that the current global trajectory is included to emphasise the greater ambition on current NDCs required to meet the Paris Agreement, as well as 1.5C and 2C trajectories. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1324	SPM	4	0			Figure SPM1: This figure could benefit from streamlining: It would be useful that the same reference years would be used for all graphics and use the same uncertainty range (e.g. likely range) for all panels. [Government of Luxembourg]

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1326	SPM	4	0			Figure SPM.1: Panel (d) clearly indicates that the sea level change is not stopping in the year 2100 and it would be very important for policy makers to have information about projected sea level rise after 2100. [Government of Luxembourg]
3130	SPM	4	0			Figure SPM.1. Recommend using the same y-axis scale for panels d-g, which all show sea level, to allow easy comparison. Height of global mean sea level panel could be increased to fit larger range. [Government of Canada]
3132	SPM	4	0			Figure SPM.1. Insert 'REGION' after 'HIGH MOUNTAIN' in key of panel (b). As written readers will get the impression that ~0.6 billion people live in high mountains, but in fact the region is defined to include anywhere with 100 km of mountain glaciers or permafrost. [Government of Canada]
4286	SPM	4	0	4		SPM.A talks about observed changes and impacts, while this figure present observed and also projected changes. It should be move at the end of SPM.A, just before SPM.B. [Government of Monaco]
4288	SPM	4	0	4		(b) Not easy to understand: - colors of global population, high mountain population, and low-elevation coastal are similar. - Neither the Annex I, nor the Figure's legend define what are the boundaries of the high mountains and low-elevation coastal. [Government of Monaco]
4290	SPM	4	0	4		(j) This indicator is not easy to understand. At first sight, it looks like a probability (% of occurence). [Government of Monaco]
4292	SPM	4	0	4		(h) Traduce the ocean heat content in a contribution to GMSL rise. [Government of Monaco]
5992	SPM	4	0	4		Colored for 'observed' and 'projected RCP2.6' are hardly discernible. [Government of Republic of Korea]
8606	SPM	4	0	4		According to panel f the upper end of the likely range under RCP8.5 is 0.36m. This amount of SLR differs from the statement at page 15 line 28-29 (B3.1): 0.28m [Government of Netherlands]
8662	SPM	4	0	4		Please also present the units on the vertical ax on the rigth side of the figures [Government of Netherlands]
8664	SPM	4	0	4		In figure k Surface ocean pH there is no marge around the two lines. Is there no uncertainty margin? [Government of Netherlands]
3622	SPM	4	1			Figure SPM.1 "Observed and projected changes in the ocean and cryosphere" is still too complex for policy makers to understand. Please add explanatory headers and simplify the figure design to ensure wide useage of this important information. [Government of Nauru]
4772	SPM	4	1			Figure SPM.1: This figure has several important shortcomings and should be thoroughly revised; main issues are: 1) it has a lot of detail but at the same time fails to provide important information, such as rates of change, developments post 2100, present day situation or the end year for observations; 2) for many processes, the year 2100 is inadequate to compare risk 3) it is a little odd to have observations and projections grouped in one graph under the "observed change" heading of section A; 4) use of the same scale for observations and projections masks a lot of information from observed record, 5) inclusion of the population dynamics and shares in SPM.1 b) is out of context in this Figure and should be removed, 6) projected 1.5°C (RCP1.9) is missing, NDC trajectory would have been helpful, 7) the use of different reference periods is very confusing and should be harmonized wherever possible. In response to some of these overarching issues, we would suggest to split the figure into 2 parts, with all processes directly related (and measured in contributions to) SLR in one part, with an extension beyond 2100 provided, and inlays with a different scale representation of observed rate of melting (cf our comment on SPM.1 d-g for details). At least current a) and c) should also be extended beyond 2100, to indicate development of changes in h-m beyond 2100, and ideally also begin before 1950 to indicate developments since preindustrial times. We would also recommend to reconsider whether all of the panels are needed to reflect the findings of the report: at this scale, the added value of a visual beyond the written statement may not be very high. However, if all panels are kept, Ocean Oxygen Content (deoxygenation, cf. Figure 5.8d) should be added as well. Further comments to individual panels are provided separately below. [Government of Germany]
4774	SPM	4	1			SPM.1 Panel j): Probability ratio, while explained in the caption, is a measure that is bound to be misunderstood, in particular since the change in the graph looks "linear", similar to all the other graphs. Also, the observations seem to deviate substantially from the model outcomes up to at least 2010, this should be explained (or corrected). The end of the observation line is not distinguishable. We'd recommend to either change the scale and metric used here, or chose a completely different representation. The authors could also consider to take out panel j (which sits a little odd here anyway, given it displays a very different metric from all other panels) and include the information provided in a different graphic format in SPM.3 for projections, and as additional box in SPM.2a for observations. [Government of Germany]

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4776	SPM	4	1			SPM.1 g-h: As said above in our general comment to Figure SPM.1, we'd like to encourage the authors to change the way observed and projected sea-level rise and glacial melt is presented here in a way that includes post-2100 developments (cf. Figure 4.2), and visually displays the acceleration in melt rates for the large Ice Sheets (cf. Figure 3.7) and Glaciers (cf. Figure 2.4) over the last decades. This could be done by "Figure 3.7-style" inlays into graphs similar to the current panels e, f, g but extended beyond 2100; and panel d could be replaced by a version of Figure 4.2. While this would still not convey a clear message about the additional committed SLR/glacier melt from near-term emissions, or a NDCs-pathway, as we had initially hoped for, it would at least allow a clear distinction between medium and long term consequences of different emission pathways. We understand that there is an additional layer of uncertainty for post 2100 projections due to the experimental set-up in CMIP5 (smaller number of models and model runs), however this can be depicted graphically and should not preclude important information from being communicated. In addition, the relative contributions to sea level rise from different elements (ocean warming, glacial melts, ice sheets) could also be portrayed through, e.g., pie charts for different time slices in past and future. [Government of Germany]
4778	SPM	4	1			SPM.1 k, l, m, n: why is there a gap between the modelled historical and future change in these panels? For Ocean pH, the observations are hardly visible, and the absence of uncertainty band seems somewhat surprising (even though it's a function of the pCO2 in the atmosphere, it stands out and needs some explanation); panel n does not really convey any information on observations and raises many questions - (why the large gap? what is the black vertical line? Isn't the current estimate highly uncertain (cf. Chapter 3.4.2.2, ranges of <5 – >25 M km2)). If this can not be markedly improved, you may want to opt against showing this specific panel. [Government of Germany]
4780	SPM	4	1			Figure SPM.1: Most panels do not show clearly the observational data; for global mean air temperature, observations are not shown at all, but should be included. [Government of Germany]
4782	SPM	4	1			Figure SPM.1 shows the developing changes in a very compacted manner. The x-axis shows the same time frame as stable reference for all the different factors on the y-axis. Especially the changing units/scale for sea level change may provoke misinterpretation. Thus, it should be checked whether the scale could be harmonized. Since change of oxygen loss is also an important development which is described in the text, authors should consider whether a graph on oxygen loss could be added in SPM.1. [Government of Germany]
4784	SPM	4	1			Figure SPM.1 is crowded and especially (d), (e), (f), (g), (h) look very similar. It is difficult to identify key aspects both for observations and future evolution of the properties, which should be a priority. Please make sure that both the current status and the separation point of RCP2.6 and RCP8.5 are visible. [Government of Germany]
4786	SPM	4	1			Figure SPM.1 (j) shows large differences between observations and hind cast modelling. This is not addressed in the caption or text. However, "marine heatwaves are increasing in frequency and severity (very high confidence)" is stated in A2. When looking at the figure, this strong statement seems questionable. Please revise the graph/caption and make sure that figure and text are consistent. [Government of Germany]
4788	SPM	4	1			If kept as is, Figure SPM.1 should use the same scale on the y-axis for (e), (f) and (g); same for (l) and (m). This would help to compare the properties. [Government of Germany]
4790	SPM	4	1			Figure SPM.1 (b): if kept as is, the lines for projections after 2010 should be drawn with a higher linewidth (they are hard to see in the present version) [Government of Germany]
4792	SPM	4	1			SPM1 could benefit from a graph on ocean deoxygenation, e.g. in the free space in the lower left. [Government of Germany]
4798	SPM	4	1			In Fig SPM.1 d-g the vertical axis should be adjusted in a way that the observed, non-linear trend is displayed more clearly, and the accelerating rate is visually distinguishable. Since this is the only graph depicting mass balance of Ice Sheets, this important fact may get lost. [Government of Germany]
936	SPM	4	1	4	1	SPM A deals with Observed changes and impacts but Fig SPM.1 mentions projected changes. This should be removed to SPM B. [Government of Jamaica]
1398	SPM	4	1	4	1	Please include a panel on long-term sea level rise, such as the information going beyond 2100 and all the way to 2300 in Figure 4.2 of the underlying report. [Government of Denmark]
7420	SPM	4	1	4	1	In Figures SPM.1 (l), (m) and (n), simulated data are shown in their absolute values, not as changes relative to a certain period. This would seem that even those simulation results that deviate largely from observations are shown as they were without some process of data correction. This may lead to apparent large uncertainties which may not necessarily reflect the reality. Thus, it seems that the data could be plotted with some type of data processing. Please note that AR5's WG1 Figure SPM.7b plots future projection by selecting simulation results with good reproducibility. [Government of Japan]
7422	SPM	4	1	4	1	Lines in figure (g) do not seem to show relative values to 2015, as the values of the lines in 2015 are not zero but negative. [Government of Japan]

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6330	SPM	4	1	4	11	Figure SPM.1b is difficult to comprehend. There are multiple scales. The projections for high mountain and low-elevation populations are similar grey shades and do not include a mean line. [Government of United States of America]
1034	SPM	4	1	4	12	Suggest that in Figure SPM.1: graph (i): observed sea surface temperature change should be shown. [Government of Australia]
1186	SPM	4	1	4	16	The panels in Figure SPM.1, which are not uniform in formatting, are suggested to be revised altogether. The number of models should also be indicated in the panels accordingly. The panels can be improved in accessibility and integrity by adding the information on Antarctic sea ice changes and the global average surface temperature sequence. [Government of China]
2634	SPM	4	1	4	16	In figure SPM1, the caption shows that each measurement seems to be using a significantly different baseline - for example GMST and GMSST is expressed relative to a 1986-2005 baseline, whereas probability of marine heatwaves is expressed relative to a 1850-1900 baseline. This is potentially confusing for the reader - could a footnote be added to explain these differences? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3136	SPM	4	1	4	16	While this figure provides a very welcome synthesis of observed and projected changes in the oceans and cryosphere, it would be very helpful to improve some of the visual aspects. For example, using the same line thickness for observations and historical model results as for projections would help. -- the thin green line in all of the panels is very hard to see compared to the heavy red and blue lines. It is also hard to understand why observations are not shown for certain elements, like historical sea surface temperature (panel 'i'), nor why an uncertainty band is shown for some elements and not others. These kinds of inconsistencies are a distraction for the reader and an impediment to clear and effective communication. The changing baseline or comparison period (1850-1900, 1986-2005, 2015 …) may also be a source of confusion and miscommunication and so should be rationalized if possible. [Government of Canada]
6332	SPM	4	1	4	16	Add an oxygen panel to Figure SPM.1. Oxygen loss is discussed in multiple parts of the SPM but is one of the only major ocean changes not depicted on the figure. There is space at the bottom left column of this figure, and an appropriate oxygen panel is presented in Chapter 5 (Figure 5.8). Climate-driven oxygen loss is too often ignored but has major consequences for ocean ecosystems and people (as discussed in Chapter 5). Adding oxygen to Figure SPM.1 will give this issue the attention it merits. [Government of United States of America]
7792	SPM	4	1	4	16	Figure SPM1 comments: Consider re-ordering the panels with the user in mind. What is the overall message of the Figure and how does each panel contribute? Broadly speaking, the figure seems to be informing us about ocean acidification (a, k), warmer oceans (c, h, i, j), sea-level rise (b, d) and the cryosphere (the rest). Use of RCP scenarios may be confusing to the reader given the use of SSP scenarios (which is already quite a challenging framework for non-experts to understand) in other SPMs. Could the scenarios instead be labelled in terms of their 2100 temperature increase? (e.g. a 4.5°C and 1.5°C scenario). Panel b: please choose different colours (two shades of grey is very subtle). Panel c and i: Is "global mean surface air temperature" the same as GMST? What is the policy relevance of including sea surface temperature in a separate panel. Suggest providing only GMST in order to aid comparability with IPCC findings from SR1.5 onwards. If this is not possible, at least provide some footnote to explain how this temperature metric relates to GMST. If a distinction between SAT and SST is essential for policy-relevant understanding of the figure, then this needs to be explained. (see Fig SPM2, panel d for inspiration). [European Union]
8650	SPM	4	1	4	16	- For policy makers it is difficult that the confidence nomenclature is not fully consistent. A example: in figure SPM.1 the following typology of confidence is used: o (d) likely range (66-100%), GMSL o (e,f) ± 1 standard deviation, Glacier mass loss o (g) likely range (66%-100%), contribution of Glacier mass loss to GMSL o (h) 5-95% range, global ocean heat content change. All these different types of confidence have the same color in the figure. A reader quickly interprets this as the same range which it is not. [Government of Netherlands]
1466	SPM	4	1	4	2	panel (b) it is unclear which SSPs the different lines refer to [Government of Italy]
3432	SPM	4	1	4	2	The panels should more clearly show /highlight the observations - now they are difficult to discern in many cases. [Government of Sweden]
3434	SPM	4	1	4	2	The series of panels to the left showing sea level rise would be useful to show with the same y-axis (scale), for easier visual comparison. Whenever possible, same reference years/period should be used, for example it is not evident why (g) should refer to 2015, and (e-f) to 1992. [Government of Sweden]

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4032	SPM	4	1	4	2	This is a great overview of the observed and projected changes. We have the following suggestions for improvement: * It would be helpful if you could indicate present day in each graph with a dotted line or something similar to that. * Graph (b) 'Population' in SPM.1: The diverging global scenarios would be easier to understand with an explainer, and using colours other than shades of gray would also help differentiate better between high mountain and low-elevation coastal areas in the lower panel. For example, consider moving the legend for high mountain and low-elevation coastal to the part of the graph where these trends are shown. * Some aspects are difficult to see in A4-format, for example the green line for observed trend in a)-g) and i)-k). This makes it difficult to judge whether there are data for such a trend or not. Please consider making the green line thicker and therefore easier to see/find. [Government of Norway]
4040	SPM	4	1	4	2	RCP2.6' and 'RCP8.5' are introduced here for the first time in the document, but without any further explanation. Given how much Representative Concentration Pathways are used in the document, the term 'RCP' could with benefit be spelled out and explained on first use. [Government of Norway]
5438	SPM	4	1	4	2	Please add information at least up to 2300. Ideally for all panels (d)-(h), at least for (d) Sea Level Rise based on Fig. 4.2. Please also adjust the y-scale for panels (e)-(h) as scenario dependence is barely visible here. [Government of Saint Kitts and Nevis]
6328	SPM	4	1	4	2	Regarding the definition of 'marine heat wave', a ~60% probability of MHW in 2100 (as shown in Figure SPM.1j for the high-emission scenario) is based on a set, non-changing baseline, while in fact the baseline for SST is slowly and continually changing as a result of global warming. So the probability of increasing heat waves in this context really just means a slow, global warming. A change in MHW frequency would require an estimate of the change in SST variability, not the mean. Though pointed out here in the context of the figure, this concern is relevant to all discussion of MHWs in the SPM (e.g., A2.2 ,B2.3). [Government of United States of America]
8384	SPM	4	1	4	2	In panel b), "inlay"should be "inset" [Government of New Zealand]
8386	SPM	4	1	4	2	In panel c), consider plotting the observed temperature. [Government of New Zealand]
8388	SPM	4	1	4	2	The different refence years/periods in these datasets is confusing. If possible, consider using a single reference period [Government of New Zealand]
8410	SPM	4	1	4	2	Bottom left corner (i): add the figure 5.8d from SROCC Chapter 5 referred to ocean deoxygenation, from 1950 to 2100, labelling it as 'Oxygen loss (100 - 600 m, relative to 1850 - 1900)'. Replace figure labels (i-n) as follows: j, k, l, m, n, o. note that the following suggestion is based on SPM A.2, A.2.5, A.2.7, chapter 1 - Box1.1 - Figure1, chapter 5, same comment for figure 'Figure TS.3' [Government of Peru]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
866	SPM	4	1	5	13	Figure SPM.1 (p.4, l.1 to p.5, l.13) General comment We welcome this figure which has been significantly improved compared to the previous version. It gives a good overview of a wide range of literature and provides very relevant information. Its readability increased a lot compared to the previous version. Introducing an additional panel about deoxygenation Please introduce a panel showing oxygen time-series as well, like in chapter 5 (figure 5-8). Among the triple threats that are widely recognized to affect the ocean (i.e. warming, acidification and deoxygenation) and which are explicitly identified to affect marine life in SROCC (e.g; in its introduction, chapter 5 mentions /"These assessments concluded that ocean warming, acidification and deoxygenation are affecting marine life from molecular processes to organisms and ecosystems, with major impacts on the use of marine systems by human societies/ deoxygenation"), deoxygenation is the only one that is not illustrated although a similar figure exists in Chapter 5. Most of the illustrated variables are related to the physics and only one concerns the green ocean. So the choice of figures does not really reflect the SROCC chapters and the different components of the ocean with the blue and white ocean much largely represented that the green ocean. (Panel b) Figure b is not very readable. If you wish to keep inlay panel b, please use colours easier to differentiate. (Panel c) We recommend in figure c to include a curve showing the observed global mean surface air temperature and not only the modelled historical temperature (Panel e and f) -"Relative to 1992" should be added in figures (e, f) to make it consistent with other figures (for example, for panel g, it is written « relative to 2015 »). - It is weird to show the standard deviation range rather than the likely range, whereas other variables indicate the likely range. The likely range is provided in ch. 4 (Tab. 4.4). Similarly, why using 1992 as reference vs 1986-2005 for other panels (and in ch. 4)? - The upper range of RCP85 in panel (f) reaches ~0.35m in 2100 while bullet point B.3.1 states that "The Greenland and Antarctic ice sheet could each contribute up to 0.28 m of sea level rise (upper end likely range) by 2100". The reason is probably not the use of standard deviation instead of the likely range (which would probably underestimate the likely range), or the use of 1992 as a reference (which should not change much compared to 1986-2005). A possible reason for this mismatch could be that 0.37 m is the contribution of the Antarctic ice dynamics, i.e. not accounting for the surface mass balance compensation (see discussion in section 4.2.3.2 vs Tab. 4.4). (Panel e f g) - Please correct the Y axis in the Figure in order to have consistent y-axis among panels e-f-g [ymin = -0.1 ; ymax = 0.4]
3134	SPM	4	1	5	13	Fig. 1n (and caption) - As mentioned in previous comment, you cannot use arbitrary terms like "near-surface permafrost" without defining the depth of "near-surface". If Fig 1n refers to area where permafrost is not found in upper 3 m (but may be found at greater depth) then indicate this. You also don't want to imply that all permafrost has thawed as it may still remain at greater depth. You also need to indicate if this refers only to Arctic permafrost (i.e. does not include mountain permafrost or permafrost in southern hemisphere). [Government of Canada]
3138	SPM	4	1	5	13	Figure SPM.1 still has room for an extra panel in the lower left corner. Ocean deoxygenation (loss of oxygen) is one of the major impacts of global warming on ocean ecosystems, as addressed in item A2.7 of the SPM text, but is visually absent from any graphics in the SPM. We propose to insert panel 5.8d (Chapter 5, page 31) as the new graphics that would become inserted as a new panel (i) in the lower left corner of Figure SPM.1. This suggestion would not be adding any new material to SROCCC [Government of Canada]
4528	SPM	4	1	5	13	We suggest to position the figure further below in the text when relevant information has been made available to understand the figure. It could be positioned after line 16 on page 7. Also try to keep consistency in the wording e.g. 'projected' (title) and 'modelled historically'-> to figure caption 'Historically modelled and observed changes in the ocean, and projected future changes this century. [Government of Belgium]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
4530	SPM	4	1	5	13	Ocean deoxygenation is discussed in many parts of the SPM but is one of the major stressors that is not illustrated in Figure SPM.1. There is space at the bottom of Figure SPM. 1 for adding an additional figure illustrating deoxygenation (e.g. Fig 5.8 chapter 5). Oxygen loss has major consequences for biodiversity and ecosystems (as discussed in Chapter 5) and adding this figure would give to deoxygenation the attention it deserves (and has in the text). " In that case, a reference to fig. 5.8. should be added as well. [Government of Belgium]
4770	SPM	4	1	5	13	The abbreviations RCP2.6 and RCP 8.5 are only explained with a footnote under B1.1. Since they are mentioned in the diagram, they should (also) be explained here, or the footnote should be added. [Government of Germany]
6334	SPM	4	1	5	13	The population graph (panel b) in Figure SPM.1 seems to appear out of the blue. Are these data an important precondition for all the other modeling? If not, delete it. All the other panels receive attention in the accompanying text, while panel b does not. Further, the plot does not follow the key, so it needs its own legend for color coding. [Government of United States of America]
6336	SPM	4	1	5	13	It is important to clearly state whether the data upon which these plots are based are from CMIP5 only, or incorporates more recent modeling efforts. Do plots e-g show NET mass loss? It would be helpful to specify. Also, would it be more correct to describe the quantities as "(contribution of) GIS/Antarctica/glacier mass loss to global mean sea level rise"? The caption should describe how marine heat waves are defined. [Government of United States of America]
6338	SPM	4	1	5	13	Both the SPM and supporting Chapter 5 adopt an over-usage of pH as a proxy for ocean acidification in both text and figures. Similar to past events in Earth's history, the ocean acidification event currently unfolding represents a period in which carbon input from the atmosphere to the ocean exceeds the rate of buffering supplied through geologic weathering (Zebee, 2017). Under these events, the entire ocean carbonate system is disrupted whereby the ratio of bicarbonate to carbonate ion is significantly altered. The relative change in pH (a measure of hydrogen concentration) for a given injection of CO2 is directly a function of this ratio (termed the buffering capacity of seawater). Two important consequences emerge: 1) the availability of carbonate ion is diminished, which represents an important building block for marine calcifiers (which to date are demonstrated to exhibit the greatest sensitivity to OA); and 2) the high frequency (e.g., daily, seasonal) dynamic range in the carbonate system will increase as a result of continued acidification. This means that the duration of marginal (or corrosive) environmental conditions that naturally occur in some systems (i.e., due to coastal upwelling, freshwater discharge events) will lengthen and grow more intense. Generally, pH has not been unambiguously identified as the primary cause of organism stress under acidification (although there are important albeit limited exceptions to this). Rather, particularly in the case of marine calcifiers that demonstrate greatest sensitivity, decreases in carbonate mineral saturation state tend to represent the most consistent predictor of organism response. Therefore, it is advised that both in figures and within the text of the SPM, more attention be afforded to carbonate mineral saturation state and pH generally be deemphasized. Furthermore, the term pH itself introduces considerable challenges in interpretation when plotted in graphs and figures provided that it represents a negative LOG transformation of a quantity (e.g., one wouldn't commonly map a figure of the -LOG[O2]). The LOG transformation over-emphasizes values at the terminus of the data set (often making them appear as outliers) and compresses mid-values. Therefore, considerable caution should be afforded when interpreting mapped images or plots that include pH. It should be noted that the concept of carbonate mineral saturation state is already adopted in several instances within the SPM supporting materials (3-19 line 36, 3-28 line 47, 5-24 lines 20-22, 5-24 lines 31-33, 5-24 lines 35-37, 5-32 lines 51-53, 5-50 lines 8-11, 5-50 lines 28-29) so it's striking that the term is not prominent in the SPM. The term carbonate mineral saturation state should be introduced in both the supporting materials and SPM by means of a box offering suitable background and context for the reader. [Government of United States of America]
2632	SPM	4	3	4	16	SPM.1: Could an additional graph (o) be added of the expected CO2 equiv emissions from near-surface permafrost extent reduction? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3638	SPM	4	3	4	3	Replace "changes this" with "changes for this" [Government of Brazil]
4294	SPM	4	3	4	3	As the reader wishes to look at trends and projections firt, we suggest - to put the vertical / ordinate grading to the right of the graph rather than to the left, - or, to put thin lines, - to put less graduation marks for pH units. [Government of Monaco]
6340	SPM	4	3	4	3	The various plots in Figure SPM.1 need to be shown relative to preindustrial as that is the reference period for the changes in global average temperature. Showing glacier mass relative to 2015 is really hiding how much change has occurred, and using 1986-2005 again hides all that has happened since the preindustrial period. [Government of United States of America]
4794	SPM	4	4	4	4	Figure SPM.1 Caption: "Context is shown…" sounds unfamiliar, please rephrase. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7562	SPM	4	4	4	4	Please give a very short explanation to RCP2.6 and RCP8.5 when mentioned for the first time here, because these central concepts run throughout the report but they might not be familiar to all policymaker readers. [Government of Finland]
8598	SPM	4	5	4	8	panel b) population. Does it not show population in high mountain region is higher growth than low lying coastal zone population? This statement is contradict with the above statement in page 2 for population projection in different regions [Government of Kiribati]
8744	SPM	4	5	4	8	panel b) population. Does it not show population in high mountain region is higher growth than low lying coastal zone population? This statement is contradict with the above statement in page 2 for population projection in different regions [Government of Kiribati]
4078	SPM	4	7	4	7	"Shared Socioeconomic Pathways" are introduced here for the first time in the document, but without further explanation. Please onsider clarifying what this is, and/or add reference. [Government of Norway]
4796	SPM	4	7	4	8	Figure SPM.1 Caption: "Additionally, around 4 million people..." the connection of this sentence is not clear, please revise or delete [Government of Germany]
1036	SPM	4	8			Suggest removing jargon: "pervasive and intensifying ocean". [Government of Australia]
8390	SPM	4	8	4	11	Is it valid to only select "pervasive and intensifying" changes for inclusion in this panel? If there are socially- or environmentally- significant variables that are unchanging, these should also be included. If all variables of interest are showing pervasive and intensifying change, then that is a powerful observation, but those attributes shouldn't be the basis for constructing this useful figure. [Government of New Zealand]
1542	SPM	4	11	5	2	Figures in SPM are intended to help to communicate the outputs from the report to policymakers and the general public, however, considering the complexity of the plots/panels on the same figure (e.g. SPM1, SPM4) it is going to be very challenging to explain these figures to policymakers. Specific comments to Figure SPM.1 include: 1) Panels (d)-(h) represent the changes in global mean sea level (i.e. panel d) and its individual components (i.e. panels e-h). The Y-axis in all panels (d)-(g) is in meters. However, for panel (h) on Ocean heat content change, the Y-axis is in Joules. It would be helpful to present ocean heat content as a contributor to global sea level rise, providing a conversion of ocean heat content to the thermostatic sea level with the same units (meters) as other components/total sea level, (see panels (d)-(g)). 2) For panels (d)-(h), we also suggest to reference time period more consistently. We note that results on each panel use/are mapped on different reference time period, e.g. 1986-2005 for the panel (d),(h), 1992 for panels (e),(f), 2015 for panel (g). 3) Results are presented in different form, estimates are given as • "… ± 1 standard deviation" (panels e,f); • "…likely range" (d, g); • "…5-95% range" (h) [Government of Singapore]
1038	SPM	4	12			Suggest clarifying. Does "surface temperature" just mean land/ocean/both? [Government of Australia]
8468	SPM	4	12	4	12	Replace "observed surface temperature" with "global mean surface temperature". If that estimate was combined air and SST, this should be noted, since the previous sentence uses global mean surface air temperature as the indicator. [Government of Canada]
6342	SPM	4	13	4	13	In the Figure SPM.1 caption, check the error range [0.61 (±0.60)]. It's the 5-95% confidence interval so rewrite for one standard deviation. [Government of United States of America]
7424	SPM	4	13	4	13	We would suggest revising the uncertainty about the observed surface temperature increase from preindustrial (1850 – 1900) to modern times (1986 – 2005) as follows based on the information in the main chapter: "0.61 (±0.6) °C" to "0.61 (±0.06)". [Government of Japan]
6344	SPM	4	13	4	15	On the projected global sea level rise panel (d), the shaded bans do not capture the uncertainty in possibilities presented. Drawing from paleoclimatic changes, the equilibrium sensitivity of sea level to changes in global average temperature is something like 15-20 meters per °C and coming out of the Last Glacial Maximum, sea level rose at an average rate of something like a meter per century when the global average temperature was rising on order of 1°C per 2000 years. The rate of temperature rise now is on order of 40-50 times what it was in the past. Suggesting that sea level rise will be less than a meter per century seems far too low and really reflects only what can be modeled, not what the risk might be if all available information is used. The report needs to indicate in both the text and figure what the range of possibilities can be, not just what models can show -- and need to indicate that the potential long-term response could well be far above the amount in the graph. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3436	SPM	4	15	4	15	Add the reference year to the panels (e-f) that show Greenland and Antarctic Ice sheet mass loss, as is shown in panels d, g-h, etc. [Government of Sweden]
1328	SPM	4	16	4	19	Please provide numbers of how much the ocean has warmed. Sea surface temperature would be one possibility. Otherwise, convert the energy stored in the ocean in A2.1 and convert it to an approximate temperature number. [Government of Luxembourg]
1330	SPM	4	21	4	31	Section A2.1 should also include information about observed changes in sea surface temperature. [Government of Luxembourg]
1332	SPM	4	21	4	31	Section A2.1: Please provide also total numbers and not only trend [Government of Luxembourg]
1334	SPM	4	21	4	31	Section A2.1: ZJ is a concept that is difficult to understand by policy makers. Footnote 6 is also not really helpful as it gives an indication for the first 100 m but the text speaks about 700 m. It would be preferable to have absolute numbers in degree centigrade. [Government of Luxembourg]
8462	SPM	4	F			Suggest deleting panel (b) showing population changes. This is presumably to indicate exposue to changes in the physical climate system but this is more simply done with text and the title of this figure does not capture population changes and exposure issues. [Government of Canada]
8412	SPM	5	1	5	13	Add: '(i). O2 concentration averaged over 100 to 600 m depth relative to the 1850-1900 period, with 90% confidence intervals {5.2.2.4, Figure 5.8d}'. Replace caption labels (i-n) as follows: j, k, l, m, n, o. [Government of Peru]
8470	SPM	5	1	5	13	Recommend explaining why in some cases, the ranges provided are 'likely' ranges while in other cases, the 5-95% range is provided. [Government of Canada]
5994	SPM	5	2	5	5	In legend of Figure SPM.1, probability of marine heat waves was expressed by probability ratio. For readability and clarity, it is necessary to express the occurrence days rather than the probability ratio. [Government of Republic of Korea]
3438	SPM	5	5	5	5	Please add "ocean" to "... Global mean surface pH". Also, the meaning of "total" scale is unclear. Is "absolute units" meant instead? Alternatively, the bit in ()'s could perhaps be omitted altogether. [Government of Sweden]
6346	SPM	5	5	5	6	Appears to be referencing the incorrect figure from Chapter 5. Caption reports it as 5.6, but should it be Figure 5.8? [Government of United States of America]
6348	SPM	5	6	5	6	Should be "sites". [Government of United States of America]
3440	SPM	5	10	5	10	Please verify if the Arctic snow cover observations really have been plotted as five-year moving averages. (Or how does this relate to the green line + shading?). ALSO, reference to Figure 3.11 would seem to be wrong as that figure shows soil carbon changes. [Government of Sweden]
3140	SPM	5	11	5	11	What is the depth reference for "near-surface" permafrost? Recommend re-wording to include depth reference: (n) Near-surface (within # m) permafrost extent..... [Government of Canada]
1336	SPM	5	12	5	16	Section A2.6: Please provide also total numbers and not only trend [Government of Luxembourg]
3696	SPM	5	12	5	16	This should refer to carbon dioxide rather than carbon which is less clear [Government of Ireland]
3144	SPM	5	16		19	This paragraph gives assessments of trends in various indicators, including a quantified likelihood (likely i.e. P>= 66%). But no period is given over which the trends are calculated. The magnitude and sign of trends in many indicators will vary depending on the time period - be it days, months, years, decades, centuries or millennia. The authors should add information on the period over which the trends described are calculated - e.g. 'over the past two decades', 'over the 1980-2018 period' or whatever is correct in this case. [Government of Canada]
2662	SPM	5	16	5	16	"The ocean is likely warming at all depths" seems a weak statement given the following paragraph (A2.1) contains mostly "high confidence" and "virtually certain" statements. Could this be replaced with "It is virtually certain the ocean has warmed down to 2000m between 1970 and 2017, attributable to anthropogenic global warming (high confidence). The ocean below 2000m has likely exhibited warming since 1992." Then follow with a separate sentence about oxygen and acidification. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4296	SPM	5	16	5	16	Should refer to anthropogenic warming, and non-anthropogenic warming, as detailed in following paragraphs. [Government of Monaco]
4800	SPM	5	16	5	16	To a non-expert, the headline statement A2 gives the impression that temperature is known not as well as the other parameters. The caveat is that the statement is covering the whole water column instead of focusing on the upper 2000m. There it is virtually certain that the ocean has warmed, and this should be in the headline. [Government of Germany]
4802	SPM	5	16	5	16	A2 is well written with short sentences and clear messages. However, the statement for temperature change in the ocean is weakened by the attempt to include "all depths". A stronger signal should be set by referring to the data on the upper layers with "high confidence"/"virtually certain" referred at this point which are shown in the report and in A2.1. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6350	SPM	5	16	5	16	KEY ISSUE [CONFIDENCE]: Other text in this document (see page 5, line 21) says that it is virtually certain that the ocean has warmed. The text of A.2 is watered down in likelihood to "The ocean is likely warming at all depths…" (note, lack of confidence statement). Low likelihood here is due to limited measurements in the deep ocean, which makes evidence and certainty for that massive region of the Earth low. In effect, this phrasing results in an overall false low likelihood (and implied lack of confidence) for a warming phenomenon that is virtually certain. Perhaps more clarity can be achieved if authors change the phrase to refer to ocean depths. [Government of United States of America]
6352	SPM	5	16	5	16	KEY ISSUE [CONFIDENCE]: Why is it not indicated that "The ocean is likely warming at all depths…" is of 'high confidence'? It is clearly established. [Government of United States of America]
7794	SPM	5	16	5	16	Suggest modifying A2 opening sentence to (so to avoid weakening opening argument with "likely"): "The upper layers of the ocean have exhibited increasing warming, with deeper layers likely to have also warmed. Overall the ocean has experience oxygen loss." [European Union]
8600	SPM	5	16	5	16	A2. The ocean is 'likely' warming. But A2.1 say 'high confidence', 'virtually certain' and reference to depths. The work 'likely'as in A2. should be change to 'high confidence'or to 'virtually certain' [Government of Kiribati]
550	SPM	5	16	5	17	Consider making seperate sentences. Mention acidification first (which is virtually certain) and loss of oxygen second. [Government of France]
552	SPM	5	16	5	17	Please rephrase this sentence in order to avoid misunderstanding about the confidence level. We recommend to seperate the ocean warming message into upper ocean (above 2000m, virtually certain) and below (likely). The sentence will not get too long, and will avoid to be misleading (even if it is precised in the paragraph below). The main message in the orange bow should contain that we are virtually certain that the oceans are warming in the upper 2000m depth layer. [Government of France]
4804	SPM	5	16	5	17	We guess that the statement .. Undergoing acidification (virtually certain)… is valid for the surface ocean and not for the whole water column. In Chapter 5 exec summary only covers the surface and near surface ocean: "The ocean is continuing to acidify in response to ongoing ocean carbon uptake. The open ocean surface water pH is observed to be declining (virtually certain) by a very likely range of 0.017 to 0.027 pH units per decade since the late 1980s across individual time-series observations longer than 15 years. The anthropogenic pH signal is very likely to have emerged for three-quarters of the near-surface open ocean prior to 1950 and it is very likely that over 95 % of the near-surface open ocean has already been affected. These changes in pH have reduced the stability of mineral forms of calcium carbonate due to a lowering of carbonate ion concentrations, most notably in the upwelling and high latitude regions of the ocean. {5.2.2.3, Box 5.1}" Either only the surface ocean is meant here - then it should be made clear in the SPM or for traceability it would have to be included in the Ch5 exec summary. Statement A2.6 also only refers to surface ocean. Please clarify. [Government of Germany]
6354	SPM	5	16	5	17	Change to "… acidification (virtually certain) and loss of oxygen (medium confidence)." Current phrasing could lead to confusion about whether "loss of" refers only to oxygen or to both oxygen and acidification. [Government of United States of America]
6356	SPM	5	16	5	17	Is oxygen loss and acidification also occurring at all depths/surface only? [Government of United States of America]
7548	SPM	5	16	5	17	The first part of the first sentence (The ocean is likely warming…) gives an impression to the reader that warming of the ocean is not very certain. Please, use text that gives a more firm impression of the warming, such as the first sentence of the text below, e.g. "It is virtually certain that the ocean has warmed unabated since 2005". [Government of Finland]
798	SPM	5	16	5	19	The headline A2. could refer to the attribution of warming as detailed in following paragraphs. [Government of France]
1426	SPM	5	16	5	19	Findings A2.5and A2.8 are not reflected in overall key finding. Consider to move section A2.3 and A2.4 to section A1 and change A1 to reflect A2.4 and A2.4 [Government of Denmark]
2642	SPM	5	16	5	19	Headline A2 statement doesn't reflect that human-induced warming is contributing to these ocean impacts as per the underlying statements. Suggest this is revised to reflect the underlying statements. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2644	SPM	5	16	5	19	There is a statement on ocean warming that is virtually certain in para. A2.1 but this headline statement only includes a medium confidence statement. Suggest that the virually certain statements are elevated to this headline statement to say something like "it is virtually certain that the ocean has warmed since 2005, continuing the trend from at least 1970, as a result of anthropogenic global warming. The ocean has taken up more than 90% of the excess heat in the climate system since 1970 (high confidence)". The first sentence in l.16 up to "loss of oxygen" should be moved to later in the para. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2658	SPM	5	16	5	19	To a lay person, the sentence in box A2 "…loss of oxygen.. And acidification" might read as though there is a 'loss of acidification' occuring. Suggest it would be clearer if the sentence is amended to read as 'undergoing acidification and loss of oxygen'. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3142	SPM	5	16	5	19	The data to support the findings in this headline are from historical observations; therefore, the past tense should be used here to describe the changes (i.e. the ocean has likely warmed, and undergone loss of oxygen and acidification; sea ice has declined etc.). [Government of Canada]
3146	SPM	5	16	5	19	Recommend instead using the results from line 24 that it is virtually certain that the ocean has warmed down to depths of 2000m. This is a stronger statement for policy-makers than the existing statement which assessed warming at all depths, including the very deep ocean. [Government of Canada]
3442	SPM	5	16	5	19	Suggest discussing sea ice under A.1, as a part of the Cryosphere. [Government of Sweden]
3694	SPM	5	16	5	19	Link warming etc to additional energy being trapped by GHGs over a certain time period [Government of Ireland]
4104	SPM	5	16	5	19	A2: Please consider exchanging the first part of A2, which is a likely statement, with very likely and/or high confidence statements following from A2.1, such as: "It is virtually certain the ocean has warmed from the surface down to 2000 m depth and unabated since 2005" and "the ocean taking up more than 90 % of escess heat in the climate system sinde 1970 (high confidence)". A3.4 is also relevant for the summary of A2, e.g.: "the rate of ocean warming has more than doubled since 1993". In addition, the 1,5C report states that "It is virtually certain that the temperature of the upper layers of the ocean (0–700 m in depth) has been increasing" (part 3.3.7 page 204). Changing the summary to statements which are considered very likely and/or with high confidence will strengthen the message compared to "likely" statements. [Government of Norway]
4108	SPM	5	16	5	19	Please consider if information about attribution to human influence can be added to this statement [Government of Norway]
4110	SPM	5	16	5	19	Please consider moving the sentence starting with "Marine heatwaves" (line 17) in front of the sentence starting with "Arctic sea ice" (line 17). [Government of Norway]
4806	SPM	5	16	5	19	The "likely" warming makes sense as it refers to the entire water column, but it seems a rather weak statement when compared to statements like on acidification (virtually certain), which relates to the surface ocean only. We would suggest to focus on warming of the upper 2000 m being "virtually certain" and leave the information on deeper layers (with lower certainties) to the text below (A2.1) [Government of Germany]
4808	SPM	5	16	5	19	A2 headline statement does not adequately reflect the paragraphs below and gives a flawed impression of (limited) changes due to uptake of heat. Suggested rewording: "A2. The ocean has warmed unabated since 2005 (virtually certain), with observed change at various ocean depths. Marine heatwaves are increasing in frequency and severity (very high confidence). The ocean is also undergoing loss of oxygen (medium confidence) and acidification (virtually certain). Arctic sea ice extent is declining (high confidence). Mixing between surface and deeper waters is being inhibited (high confidence)." [Government of Germany]
6358	SPM	5	16	5	19	The order of impacts listed in the A2 box does not match the order of subpoints that are then discussed below. Recommend having the summarized order of concepts in A2 match the order of the discussion of ideas in A2.1-A2.8, so that flow of this section is more cohesive. [Government of United States of America]
6360	SPM	5	16	5	19	Section A is concerned with observed changes and impacts. Chapter 6 (specifically 6.4.2) has 'impact on natural, physical, and human systems' but there is no corresponding SPM text despite extensive listings of impacts from MHWs in 6.4.2.1 (impacts on marine organisms and ecosystems such as harmful algal blooms and shellfish poisoning), 6.4.2.2 (impacts on the physical system including shifting winter storms tracks leading to drought along the U.S. West Coast, flooding due to greater atmospheric water vapor/precipitation along the Peruvian coast), and 6.4.2.3 (impacts on human system, including reduced fisheries harvest). [Government of United States of America]
8436	SPM	5	16	5	19	The reference to "loss of oxygen", such as is being observed off Peru, and to the "increase in frequecy and severity" of marine heatwaves, such as the 2017 "coastal El Niño", is of great importance and thus we salute that it is considered in this key point. [Government of Peru]
8658	SPM	5	16	5	19	Add temperature changes in range in degrees Celcius [Government of Netherlands]
8670	SPM	5	16	5	19	Is the ocean also undergoing loss of oxygen at all depths. If so, please be more specific. Be more specific about the acidificaiton. How much in which period? Text could be changed to; "The ocean is virtually certain warming over 0-2000 m. The deep ocean below 2000 m is likely warming. Arctic sea ice extent is declining (high confidence), with a September sea ice reduction of more than very likely 37% over the last 30 years. Marine heatways are increasing in frequency and severity (very high confidence). [Government of Netherlands]
7796	SPM	5	16	5	21	The choice of words in the two statements (first sentence of A.2 vs first sentence of A2.1) virtually next to each other is poor – whereas it is understandable that one relates to all depths, and the other does not, it is still poor to first say “the ocean is likely warming […]” followed by “it is virtually certain that the ocean has warmed […]” – there needs to be a consistent language use in these key messages. [European Union]
4810	SPM	5	16	5	22	A2. should begin with the strong statement from A2.1: "It is virtually certain that the ocean has warmed since 2005…" in order to transport the information on the very well known temperature rise of the upper ocean. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3564	SPM	5	16	5	30	The sea level rise is also reported to be a consequence of global warming. Sri Lanka, being a small island country, is predicted to be vulnerable to such a sea level rise. As per the global projections based on different scenarios, the global mean sea level rise by the year 2046–2065 would be 0.24–0.30 m and that for 2081–2100 would be around 0.26–0.82 m (IPCC, 2013). The coastal regions are also expected to be affected by sea level extremes and high waves. Salt water intrusion and high waves can adversely affect biodiversity in the coastal ecosystems. Being an island country with long beaches, such impacts are very significant for Sri Lanka. [Government of Sri Lanka]
3792	SPM	5	16	5	31	As warming is unequivocal surely ocean warming is also unequivocal? [Government of Ireland]
6362	SPM	5	16	6	29	For clarity, it would be best if the subsections aligned with how they are presented in Figure SPM.2 (i.e., A2 physical changes: A2.1 - temperature, A2.2 - sea level,…). [Government of United States of America]
4106	SPM	5	16	7	16	A2-A3: it could be more intuitive to organize these findings such that everything on ocean warming is covered in A2 while sea level is coverd in A3. I.e. move A3.3 to A2. This would also make it easier to write more precise and informative summaries of these two parts. [Government of Norway]
554	SPM	5	17	5	17	Should it no be "very high confidence" instead of "high confidence" for Arctic sea ice decline? [Government of France]
3148	SPM	5	17	5	17	Consistent with line 39, recommend adding to the headline statement sentence on arctic sea ice decline that declines have occurred in all months of the year. This is important information because much of what is reported on in the news is about summer sea ice declines. Para A2.3 could then identify the summer season and/or September as the period of strongest decline. [Government of Canada]
6364	SPM	5	17	5	17	KEY ISSUE [CONFIDENCE]: "Arctic sea ice extent is declining (high confidence)." Why is this not very high confidence? Is this because the satellite record does not begin before 1979? [Government of United States of America]
7580	SPM	5	17	5	17	"Arctic sea ice extent and thickness are declining" [Government of Finland]
4812	SPM	5	17	5	18	Related to marine heatwaves a temporal frame should be set to make clearer that this is a quite new phenomenon (cf. A2.2). [Government of Germany]
4814	SPM	5	20	5	31	The first sentence could be part of the headline A2. A2.1 provides warming rates 1970 - 2017 and 2005 -2017, while statement A3.3 (page 6 lines 46-49) gives warming rates from 1969 to 1993 and 1993 to 2017 and in A3.2 it is clearly stated that the warming rates have more than doubled. A2.1 and A3.3 need to be addressed jointly and either the time periods from A2.1 or from A3.2 should be in the SPM. Statement A3.3 seems preferable as it is a lot more clear. Also, please address first the global situation and then state the contribution of the Southern ocean. It would also help to clarify why the southern ocean is mentioned and not another part of the ocean. The southern ocean statements are not in the Exec summary of Chapter 5, but should be there if the southern ocean statement is so important that it is highlighted in the SPM. [Government of Germany]
4820	SPM	5	21		21	The term "unabated" might be misread as referring to an absence of climate change mitigation measures. Please consider to replace it by an unambiguous term such as "continuously", "continually", "steadily" etc. [Government of Germany]
3150	SPM	5	21		22	The statement that 'it is virtually certain that the ocean has warmed unabated since 2005' does not specify a depth range, and therefore implicitly applies to the whole ocean. But the underlying assessment in Section 5.2.2.2.1 only concludes that it is 'virtually certain' that the upper ocean has warmed. Revise to be consistent with the underlying assessment. [Government of Canada]
1042	SPM	5	21	5	21	Suggest clarification: ‘virtually certain' should be italicised? [Government of Australia]
2650	SPM	5	21	5	21	Should "virtually certain" be in italics like elsewhere in the text? [Government of United Kingdom (of Great Britain and Northern Ireland)]
2652	SPM	5	21	5	21	It is not clear what is meant by 'unabated' in this context. Unabated would normally tend to mean that there are no processes working to cool the ocean (which is presumably not the case). Does it mean continuously in this context? Does it mean that no anthropogenic methods have been used to reverse the warming? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3444	SPM	5	21	5	21	Please use italics for "virtually certain", if the words here signify calibrated uncertainty language. [Government of Sweden]
6366	SPM	5	21	5	21	KEY ISSUE [CONFIDENCE]: Why virtually certain since only 2005 (explain if this is due to the availability of direct observations). [Government of United States of America]
6368	SPM	5	21	5	21	"unabated" is an unclear term in this context. Is there a better choice to make this point (e.g., uninterrupted, steadily)? Or possibly just delete the modifier? [Government of United States of America]
6370	SPM	5	21	5	21	Should this be "…since AT LEAST 2005,…" or "…FROM 2005 TO THE PRESENT,…" ? [Government of United States of America]
4816	SPM	5	21	5	22	Please consider to move "The rate of ocean warming has more than doubled since 1993 (likely)" from A3.3 to here [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6372	SPM	5	21	5	22	A couple of suggestions for this sentence: 1) The word "unabated" could be confusing to the reader because abatement often implies a human intervention. Also, the use of "virtually certain" (not italicized) in the sentence introduces an element of uncertainty that could be clarified by the following phrasing: "Observations indicate that the the ocean has warmed continuously since 2005 (virtually certain)..." 2) "going back to at least 1970" is an ambiguous phrase, because it could theoretically encompass any time period before 1970. Suggest noting the characteristics of pre-1970 records (perhaps less spatially extensive, less accurate?) and describing their trends, or the inability to draw conclusions from them as the case may be. [Government of United States of America]
1550	SPM	5	21	5	31	Understand the intent to capture the notion of the ocean in absorbing heat, but using energy metrics (Zettajoule) to represent warming is not intuitive for policy makers, even though the footnote provides an explanation. Suggest to reflect in deg C instead, or include in the main text to state what the ZJ numbers translate to in deg C. [Government of Singapore]
4818	SPM	5	21	5	31	This para contains many numbers that need context so that the reader can understand the dimension and significance of change. Please consider whether this level of technical detail is really necessary to convey the central finding (accelerated uptake of heat by ocean?) to policymakers. Maybe the relative change would be more appropriate format. If exact numbers are kept, please consider providing the magnitude of total energy stored in the ocean as corollary, and possibly use Tera or Peta J, not Zeta that might be less known to the audience of IPCC reports. [Government of Germany]
7798	SPM	5	21	5	31	The rate of warming in deg C should be provided. This is by far the most intuitive measure of changes in the ocean, and but is omitted here. The units of "warming" here are instead given as ZJ/yr. This is an incredibly uninuitive unit to work with but could be easily converted to degrees / yr averaged over the upper and middle layers for example. [European Union]
7698	SPM	5	21	5	40	we reiterate our comment of maximizing the use of tables for figures, uncertainty ranges, units, periods of time, etc.Text should be easier to read, there are paragraphs that are hard to read even for scientists. Policy makers won't look at them. [Government of Spain]
6374	SPM	5	21	6	28	There may be a good reason for the order of the points under A2, but A2.3 and A2.4 seem out of place in the middle of the ocean points. It seems to make sense to put those either first or last in this section so that all of the ocean-specific statements are in sequence. [Government of United States of America]
7800	SPM	5	21	6	28	Key findings A2.2, A2.3 and A2,6 should spell out impacts of the key observation as other findings in the same section do where relevant (e.g. A2.4, A2.5 and A2.7 do). What are the potential impact of marine heatwaves, polar sea ice extent loss (e.g. negative for emblematic biodiversity), ocean acidification (e.g. for coral reefs which is then further laid out in A6.3)? [European Union]
1040	SPM	5	21	6	49	Suggest including a comparison of summary A2.1 with A3.3. Currently, it appears as though the values in these two sections compete against each other. [Government of Australia]
3152	SPM	5	22		24	An assessment of how much human activity has warmed the oceans should be a key component of the SROCC assessment. AR5 assessed that 'It is very likely that anthropogenic forcings have made a substantial contribution to upper ocean warming (above 700m) observed since the 1970s', based on assessment of a range of attribution studies. The assessment here that 'That warming is attributable to anthropogenic global warming' is vague, and lacking an associated uncertainty qualifier. The previous sentence 'It is virtually certain that the ocean has warmed unabated since 2005, continuing well documented trends going back to at least 1970' does not specify a depth range, and therefore presumably applies to the whole ocean. Secondly, the sentence does not specify how much of the warming is anthropogenic (c.f. the AR5 'substantial contribution'). Thirdly, the meaning of 'is attributable to anthropogenic global warming' is not clear - is this equivalent to saying 'is attributable to anthropogenic forcings', or does it mean something else? Finally the statement as written does not have a likelihood qualifier associated with it, as all high confidence attribution assessments in the AR5 do. The sentence ends with 'high confidence' in brackets, but it isn't clear if this applies only to the assessed fraction of heat taken up by the ocean, or the whole sentence. Strongly recommend re-formulating this statement along the lines of the AR5 statement, with either a strengthened likelihood qualifier and/or a different depth range, if the underlying assessment supports this. [Government of Canada]
3154	SPM	5	22		24	None of the sections cited at the end of this paragraph appear to contain an assessment of the attribution of ocean warming. Section 5.2.2.2.1 describes a comparison of observed changes in ocean heat content and simulated changes in CMIP5 ESMs, but it does not reach an assessment on the anthropogenic contribution to the observed warming. Recommend adding assessment of ocean heat attribution to underlying chapters to support a revised attribution statement in the SPM. [Government of Canada]
8214	SPM	5	22	5	22	confidence statement needed [Government of Austria]
8472	SPM	5	22	5	22	Change "is attributable to" to "is attributed to". The first formulation could be interpreted to mean that attribution is possible, whereas the second formulationsounds more definitive. Consistency in use of 'is attributed to' in the SPM is recommended to avoid confusion about whether these two phrases mean different things. [Government of Canada]

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6376	SPM	5	23	5	23	rather than "...since 1970...", use "...FROM 1970 TO THE PRESENT..." [Government of United States of America]
2646	SPM	5	24	5	24	the '0-700m' and '700-2000m' depth layers won't mean much to a policy audience - could you add in 'surface' and 'mid depth' layers if appropriate here? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6378	SPM	5	24	5	25	Add "that" after "certain", and remove the redundant "of the ocean". Explain ZJ. [Government of United States of America]
6380	SPM	5	24	5	25	Modify the sentence as follows: 'Between 1970 and 2017, it is virtually certain that the ocean has warmed over both the 0-700 m and 700-2000 m layers...' [Government of United States of America]
1414	SPM	5	24	5	29	Scale the ocean energy uptake to something imaginable (for instance fossil fuel energy consumption from XXX) [Government of Denmark]
4298	SPM	5	25	5	25	ZetaJoule is not a unit that is very understandable to non-scientists. Couldn't it have been possible to transform this unit of energy into a temperature increase? [Government of Monaco]
800	SPM	5	25	5	26	Please consider using units which are understandable for policymakers. Using zetajouls while refering to a warming is confusing and not understandable. Warming should be expressed in °C per decade (or something equivalent), while the concept and consequences of the energy fluxes (expressed in ZJ yr-1) should be clearly explained for non physicians if they are introduced. [Government of France]
6382	SPM	5	25	5	26	Explain why these depths (0-700 and 700-2000m) are distinguished or at least identify them with a descriptive term -- i.e., upper ocean and intermediate ocean depths? [Government of United States of America]
6384	SPM	5	25	5	26	The trend is of heat uptake, not warming. [Government of United States of America]
3640	SPM	5	25	5	28	Replace "0-700m" with "0-700 m" and "700-2000m" with "700-2000 m" [Government of Brazil]
4822	SPM	5	25	5	28	The mentioned rates in ZJ describe a rate of heat uptake and not a warming rate. The oceans warmed by taking up the mentioned rates. Please reformulate the sentence to be concise. [Government of Germany]
2636	SPM	5	25	5	31	Footnote 6 is very useful for explaining ZJ and what this means in terms of rate of warming. However for busy policymaker this could be missed. Can rate of warming also be put into % per decade, or equivalent? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4824	SPM	5	25	5	31	Please consider omitting the numbers of warming (ZJ), as most policy makers will not know how to interpret them. Hold on to relative statements such as "The Southern Ocean accounted for 35-43% of the heat gain". [Government of Germany]
1022	SPM	5	26			Suggest consistency. ZJ is being used for ocean warming. However, warming is reported in degrees Celsius and changes in heat content/energy in Joules. Planetary warming is reported in degrees Celsius for every other IPCC SPM. [Government of Australia]
4164	SPM	5	26	29	5	It is not so easy to understand whether the first part of the "Averaged between 2005 and 2017"-sentence is regarding the Southern Ocean or the global average, since the Southern Ocean is referred to alone in the second part of the sentence. Maybe this could be split into two sentences to avoid confusion? [Government of Norway]
8392	SPM	5	26	5	26	What confidence interval applies to the range 35-43%? [Government of New Zealand]
556	SPM	5	26	5	27	Such level of confidence is consistent with the ESM of chapter 3, but consider revising it (too high confidence: observations are very very sparse pre-1990, and this level of confidence is not supported by Chapter 3 text). [Government of France]
6386	SPM	5	26	5	28	Most readers are not familiar with ZJ yr-1 as units. When talking about warming trends (e.g., A2.1, A3.3), is it possible to include °C for a general audience? [Government of United States of America]
8474	SPM	5	26	5	29	The increase in the % heat uptake by the Southern Ocean from 2005-2017 would have more impact if compared to the % heat uptake from 1970 to 2005 (rather than the reported % heat uptake over the whole period. [Government of Canada]
6388	SPM	5	27	5	27	Remove 'very likely' from text and place it parenthetically and italicized to match other text. [Government of United States of America]
6390	SPM	5	27	5	28	"very likely warming rates" is poor syntax. Reword. [Government of United States of America]
6392	SPM	5	27	5	28	Awkward wording. It is a trend in heat uptake and not warming, and "very likely" is not properly placed in the sentence. [Government of United States of America]
558	SPM	5	28	5	28	Please indicate "global" before "warming rates" to make it clearer that this is not for the Southern Ocean. [Government of France]
1044	SPM	5	29			Suggest defining "taken up". [Government of Australia]
560	SPM	5	29	5	29	"46-": It should be 45 (to be consistent with Table 3.1 and chap 3 p.3-3, p.3-18). [Government of France]
1188	SPM	5	29	5	29	"46-62%" is inconsistent with the finding in the underlying report, which states in Chapter 3 on page 18 that "The heat gained by the Southern Ocean south of 30 °S was 45-62% of the global ocean heat gain". It is suggested that the relevant numbers be checked and revised. [Government of China]
2638	SPM	5	29	5	29	Suggested change to text: 'increased by 46-62%' [Government of United Kingdom (of Great Britain and Northern Ireland)]

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2640	SPM	5	29	5	29	Suggested addition to text: 'A relatively short observational record indicates that the deep ocean below 2000m…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4826	SPM	5	29	5	29	pls. substitute '46' by '45' (p. 3-18) [Government of Germany]
8394	SPM	5	29	5	29	What confidence interval applies to the range 46-62%? [Government of New Zealand]
6394	SPM	5	30	5	30	Replace 'exhibited' with 'experienced'. [Government of United States of America]
6396	SPM	5	30	5	30	Should this be "…warming since AT LEAST 1992,…" or "…FROM 1992 TO THE PRESENT,…" ? [Government of United States of America]
6398	SPM	5	30	5	31	It is not clear how the authors derived the likelihood statement for deep ocean warming below 2000m. The SPM states that the deep ocean below 2000m has likely exhibited warming since 1992, especially in the Southern Ocean. Section 3.2.1 states that there is medium confidence that the ocean below 2000m stores ~19% of excess anthropogenic heat but provides no likelihood. Perhaps this is noted in another section or could be clarified in Chapter 3? [Government of United States of America]
3698	SPM	5	30	5	33	Is observerved sea-level rise not unequivocal? [Government of Ireland]
1390	SPM	5	33	5	34	is "ocean surface temperature" different from the more often used "sea surface temperature"? If not, use the latter. If there is a difference, please explain it. [Government of Denmark]
2660	SPM	5	33	5	34	The observed doubling of marine heatwaves is compared to a 1982 baseline but in section B2.3 the projected frequency of heatwaves is compared to an 1850-1900 baseline. Suggest that it would be more easily understandable by policy makers if a consistent baseline is used in sections A and B. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6400	SPM	5	33	5	34	"…high ocean surface temperatures…" High compared to what? The long-term mean? [Government of United States of America]
2648	SPM	5	33	5	37	Globally or has the increase in intensity and extent of marine heatwaves been in specific regions? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3156	SPM	5	33	5	37	Marine heatwaves: recommend adding the clarification that these have occurred in all ocean basins (consistent with Ch. 6 executive summary). Otherwise, readers may assume these only occur where ocean temperatures are high (i.e. tropical oceans) and don't include the Arctic Ocean (for example). [Government of Canada]
3158	SPM	5	33	5	37	The significance (viz. importance) of a marine heat wave from a global perspective (as opposed to particular low latitude habitats) is unclear in this bullet, as also is the definition. Does it involve a threshold temperature, a duration, a depth of penetration? Is it defined differently at different latitudes, or in different oceanic domains? Is it principally a coastal issue? Without such clarification, and the additional words that such require, this bullet isn't particularly useful. [Government of Canada]
6402	SPM	5	33	5	37	Define marine heatwaves in the SPM. Is it based upon an anomaly, or statistical definition? [Government of United States of America]
7802	SPM	5	33	5	37	Additions describing the consequences of marine heatwaves on the frequency of hurricanes, on corals, on fisheries and acquaculture, would provide policy-relevant information. References to previous IPCC reports and to the underlying chapters of SROCC would support the information provided. [European Union]
8438	SPM	5	33	5	37	Peru has recently experienced the highly-damaging "coastal El Niño" in 2017, which can be considered a "marine heat wave". Thus, we salute that their very likely increase and the role of anthropogenic warming is indicated in the SPM. [Government of Peru]
4828	SPM	5	33	9	11	Subsection A2.2 and A6.3 provide similar information, please combine and shorten. In addition, please consider to remove some of the technical details and find a more accessible format for the quantitative information provided (e.g. relative change). [Government of Germany]
4532	SPM	5	35	5	35	..more intense and more extensive : Please clarify. Is it in area? In volume?… [Government of Belgium]
562	SPM	5	35	5	36	We suggest to add "and subsequent ocean heat uptake" after "anthropogenic warming" [Government of France]
4300	SPM	5	35	5	36	This is the assumption. Written like this, one wonders what the other 16-10% of marine heatwaves are attributed to? [Government of Monaco]
8396	SPM	5	35	5	37	This attribution statement would be improved by including the actual number of marine heatwaves in this period. It's also unclear whether "can be attributed" refers to their very existence, or to some aspect of their intensity and/or duration. [Government of New Zealand]
6404	SPM	5	36	5	44	In line 36, the phrase "anthropogenic warming" is used and, in line 44, "anthropogenic global warming". Be consistent. [Government of United States of America]
2654	SPM	5	39	5	39	Arctic sea ice extent is declining in all months of the year' sounds as if the sea ice is continually melting, without any recovery in the winter months. It might be better to specify that this means 'year-on-year' ice extent decline. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6406	SPM	5	39	5	39	Sea ice extent waxes and wanes seasonally. Might it be better to state 'Mean Arctic sea ice extent…'? [Government of United States of America]
6408	SPM	5	39	5	39	Over what duration of time have Arctic ice extents been declining in all months? [Government of United States of America]

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4534	SPM	5	39	5	40	This sentence is very confusing … Sea ice reduction in the satellite era has resulted in low sea ice for at least 1000 years? … surely the satellites had nothing to do with it…. just the way it is written is not clear. [Government of Belgium]
3160	SPM	5	39	5	41	Current wording is confusing and implies that unprecedented low sea ice extent has persisted for 1000 years. Recommend re-wording latter part of the sentence to make it clear that the recent reductions in September sea ice extent are unprecedented over the past 1000 years. [Government of Canada]
7804	SPM	5	39	5	41	A2.3 Arctic sea ice extent is declining in all months of the year (high confidence). September sea ice reductions in the Arctic during the satellite era (1979-2018; very likely 12.8 ± 2.3% per decade) have resulted in unprecedented low sea ice extent for at least 1000 years (high confidence) - This sentence does not make sense, likely wrong use of English? If the point is to contrast the observation of the satellite ers with the previous 1000 years, it should be clarified how a valid comparison can be made (are there comparable data sources, or some proxy indicators were use to make the pre-observational period comparable). [European Union]
8398	SPM	5	39	5	41	change word order: "...have resulted in low sea ice extent unprecedented for at least 1000 years" [Government of New Zealand]
564	SPM	5	39	5	44	One of the major impacts in the Arctic that should be mentioned and is relevant to ecosystem and human activities is the increase in ice free-season duration by >5 days per decade due to earlier retreat and later ice advance. There are other changes in sea ice features (snow depth reduction) that are documented and might deserve mention. Maybe a generic sentence on other impacts on sea ice features would by worth ? [Government of France]
4202	SPM	5	39	5	46	Please consider also mentioning changes in ice volume. [Government of Norway]
4642	SPM	5	39	5	46	Suggestion: to re[lace 'approximately half of the observed sea ice loss is attributed to anthropogenic global warming (medium confidence)' with 'The observed sea ice loss is attributable to global warming (high confidence)' [Government of Russian Federation]
6410	SPM	5	39	5	46	KEY ISSUE [CONFIDENCE]: Why is the sea ice extent decrease only very likely but the thinning is virtually certain. Any reasonable assessment of current knowledge would reverse them, or at minimum make both the same level. Thinning being more certain than changes in extent is a bit jarring. [Government of United States of America]
7426	SPM	5	39	6	3	We would like to suggest additionally mentioning the relationship between the sea ice extent reduction and the air-sea CO2 flux change in the Arctic Ocean, since this would offer new insights into the role of the ocean in the global carbon cycle and complement the latest and policy relevant research based on integrated global observation. Deepening the understanding of the carbon uptake contribution in the Arctic ocean would also be invaluable for policy makers, as well as for the furtherance of the greenhouse gas monitoring and the understanding of the global carbon cycle, since the Arctic sea ice extent has been reduced and will continue to decline in the coming decades. In particular, as the Southern Ocean CO2 flux is mentioned in the underlying chapter 3.2.1.2.4, it would be very much appreciated if the SPM as well as the appropriate underlying chapters could mention also the CO2 flux in the Arctic Ocean by referring to the findings in the latest research (e.g., Yasunaka et al., 2018: Arctic Ocean CO2 uptake: an improved multiyear estimate of the air – sea CO2 flux incorporating chlorophyll a concentrations Biogeosciences 15, 1643-1661). [Government of Japan]
3448	SPM	5	39	6	4	Discussion on sea ice in A2.3 and A2.4 could be moved into section A.1 that considers the Cryosphere. [Government of Sweden]
4830	SPM	5	40	5	40	The „very likely“ assessment for the specific numbers of Arctic sea-ice decline are inconsistent with the main text in section 3.2.1.1.1, and with the ES of chapter 3 where no likelihood level is assigned to these numbers. It also is inconsistent with figure SPM.1, where the 5-95 % spread of the satellite products is taken as the „likely“ range. [Government of Germany]
4832	SPM	5	40	5	40	very likely' not found in the original text (p.3-12); pls check [Government of Germany]
1046	SPM	5	41	5	41	Suggest clarification: "…sea ice extent for at least the last 1000 years". [Government of Australia]
4834	SPM	5	41	5	41	The „high confidence“ level for the 1000-year context of Arctic sea-ice conditions is inconsistent with the main text of the report in section 3.2.1.1.1. There this statement is only assigned „medium confidence“, which must be reflected here. [Government of Germany]
4836	SPM	5	41	5	41	in the original text is mentioned 'medium confidence'(p.3-12); pls. check and revise [Government of Germany]
6412	SPM	5	41	5	41	The phrasing of this sentence is confusing. It's that the low sea ice extent is unprecedented in the last 1000+ years, not that the extent has been low "for at least 1000 years". [Government of United States of America]
6414	SPM	5	41	5	41	Should this be "…for at least THE PAST 1000 years…"? [Government of United States of America]
6416	SPM	5	42	5	42	Remove : and instead end sentence here. Since 1979 should be a new sentence. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3162	SPM	5	43		44	AR5 assessed that 'Anthropogenic forcings are very likely to have contributed to Arctic sea ice loss since 1979' (Bindoff et al., 2013). This SPM assesses 'Approximately half the observed sea ice loss is attributed to anthropogenic global warming (high confidence).' Note that no period of time or month of the year is given. Section 3.2.1.1.1 contains the statement 'Approximately half of the observed Arctic summer sea ice loss is driven by increased concentrations of atmospheric greenhouse gases, with the remainder attributed to internal climate variability (Kay et al., 2011; Notz and Marotzke, 2012) (medium confidence).'. (Note that the SPM statement is implicitly for the whole year, whereas the Chapter 3 statement is for summer only; the SPM statement is high confidence, whereas the Chapter 3 statement is medium confidence). The Chapter 3 assessment is itself based on only two published studies, both already assessed in AR5, Chapter 10. Of these, Notz and Marotzke (2012) do not say anything about the fraction of the observed trend which is due to anthropogenic influence, and Kay et al. (2011) say 'Comparing trends from the CCSM4 ensemble to observed trends suggests that internal variability explains approximately half of the observed 1979–2005 September Arctic sea ice extent loss.' So an SROCC SPM statement that approximately half of observed sea ice loss 'is attributed' to anthropogenic global warming with high confidence is based on a comparison of observed September sea ice trends over 1979-2005 with simulations from a single climate model, leading the study's authors themselves only to conclude that their comparison *suggests* that internal variability explains approximately half of the observed trend. Note that other models with other rates of sea ice loss would lead to different conclusions about the fraction of observed sea ice loss which is due to internal variability. Note also that this assessment does not assess several other attribution studies of sea ice loss published since 2011, including Kirchmeier-Young et al. (2017; 10.1175/JCLI-D-16-0412.1) and Mueller et al. (2018, 10.1175/JCLI-D-17-0552.1). Kirchmeier-Young et al. (2017) found that the observed evolution of September Arctic SIE was close to the CMIP5 multi-model mean (Figure 5d) i.e. the best estimate is that anthropogenic forcing explains all of the September trend in Arctic SIE. Recommend reverting to the AR5 assessment on this topic, given that no new literature was assessed in this report to inform an update, and the AR5 assessment on the attribution of SIE changes is more thorough. [Government of Canada]
4838	SPM	5	43	5	43	This statement is consistent with the main text in section 3.2.1.1.1. However, the ES of chapter 3 assigns a „very likely“ likelihood to this statement, which is inconsistent with the main text in section 3.2.1.1.1. and inconsistent with the SPM. [Government of Germany]
1190	SPM	5	43	5	44	"sea ice loss", which is an non-standard expression, is suggested to be replaced with "reducing sea ice extent". [Government of China]
2656	SPM	5	43	5	44	The text states that half of observed sea ice loss is attributed to anthropogenic global warming- this begs the question what the rest is attributed to? It would be helpful to state "with the remainder attributed to internal climate variability" as in the underlying report (page 3-13) [Government of United Kingdom (of Great Britain and Northern Ireland)]
4216	SPM	5	43	5	44	The text is stating that approximately half of the observed sea-ice loss is attributed to anthropogenic global warming. It could be useful to add a sentence describing what kind of natural variability the other half is believed to result from. [Government of Norway]
6418	SPM	5	43	5	44	"Approximately half of the observed sea ice loss is attributed to anthropogenic global warming (medium confidence)." This is a weak statement, though looking at 3.2.1 there does not appear to be much more that can be said. [Government of United States of America]
7806	SPM	5	43	5	44	Please, consider rephrasing or deleting this sentece as it does not reflect the messages in chaper 3, section 2.1. [European Union]
4302	SPM	5	44	5	44	"attributed to anthropogenic global warming" Same comment as above [Government of Monaco]
6420	SPM	5	44	5	44	Policymakers will want to know what the other half is attributed to, if not anthropogenic global warming. [Government of United States of America]
6422	SPM	5	44	5	44	Quantify "unusually low". [Government of United States of America]
566	SPM	5	44	5	45	Please consider mentionning that there are significant trend in regional changes. Please consider better reflecting the following sentence : Chap 3, p. 3-14 "A significant positive trend in mean annual ice cover between 1979 and 2015 (Comiso et al., 2017a) has not persisted, due to three consecutive years of below-average ice cover (2016-2018) driven by atmospheric and oceanic forcing." [Government of France]
568	SPM	5	44	5	45	The evolution of Antarctica sea ice is one of the new results and could be highlighted, along with other major or recent results. [Government of France]
4222	SPM	5	44	5	45	It is stated that "Antarctic sea ice extent has no statistically significant trend' yet it has been 'unusuallly low since 2016'. Given statistical insignificance, what does 'unusually low' mean here? Please consider providing an explanation/definition. [Government of Norway]
6424	SPM	5	44	5	45	Not sure about high confidence applied to "no statistically significant trend" for Antarctic sea ice. Through 2018 that is true but, until 2016, several months had significant (95% level) increasing trends (albeit small). If extent is high over the next couple of years, the trends could be significant again. [Government of United States of America]
8476	SPM	5	44	5	45	Recommend not including the last part of this sentence about Antarctic ice extent being unusually low since 2016 since short periods of time can be strongly influenced by short-term variability. Chapter 3 Ex Summ concludes that there is limited evidence and low agreement about the causes of the recent declines. [Government of Canada]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4630	SPM	5	44	5	46	Antarctic sea ice extent has been unusually high in 2014-1015, so the upward trend was statistically sinificant until then. There is no reason to mention that it has been low since 2016, because these kind of interannual variations are presumably internal. [Government of Russian Federation]
6426	SPM	5	44	5	46	Meehl et al. (2019) suggest that the sustained decreases of Antarctic sea ice extent after late 2016 are associated with a warmer upper Southern Ocean. This is the culmination of a negative decadal trend of wind stress curl with positive Southern Annular Mode and negative Interdecadal Pacific Oscillation, Ekman suction that results in warmer water being moved upward in the column closer to the surface, a transition to positive Interdecadal Pacific Oscillation around 2014-2016, and negative Southern Annular Mode in late 2016. Would it be possible to note in the SPM that the current literature suggests that the sea ice extent decrease is due to a warmer upper Southern Ocean? [Government of United States of America]
7428	SPM	5	44	5	46	The expressions “The Antarctic sea ice extent has ‘no statistically significant trend’ (1979 to 2018) and has been ‘unusually low since 2016 (high confidence).’” would seem mutually inconsistent and thus, revisiting the wording would be suggested. Also, “high confidence” would seem contradictory, as the Figures 3.3 (f) and (h) of the underlying Chapter 3, do not seem to show that the Antarctic sea ice extent has been continuously low since 2016. [Government of Japan]
8400	SPM	5	44	5	46	Consider including mention of the "significant positive trend in mean annual ice cover between 1979 and 2015" (section 3.2.1.1.1) as well as the recent low levels. [Government of New Zealand]
3446	SPM	5	45	5	45	The "and" could be changed to "but" for a better flow of thought. [Government of Sweden]
6428	SPM	5	45	5	45	"unusual" compared to what? A numerical statement would be better. [Government of United States of America]
6430	SPM	5	45	5	45	Change "and" to "but". [Government of United States of America]
7582	SPM	5	45	5	45	Please, replace "and" by "but" to improve the logics of the sentence. [Government of Finland]
8540	SPM	5	45	5	45	What does "unusually low" mean? Unprecedented since 1979? Given there's been no significant trend since 1979, saying that its unusually low over the past few years seems a bit meaningless if not better quantified. [Government of Switzerland]
4304	SPM	5	45	5	46	This sentence leads to confusion: there is a trend even if Antarctic thaw was low in 2016-2017. Can be added the precision made in A3.2 and 3.3.1.1. This conclusion sentence can be proposed to end this paragraph: This rapid mass loss may indicate the beginning of Marine Ice Sheet Instability, but observational data are not yet sufficient to determine whether these changes mark the beginning of irreversible retreat. {3.3.1; Cross-Chapter Box 8 in Chapter 3; 4.2.3.1.2} [Government of Monaco]
6432	SPM	5	48	5	48	To clarify text, change to "...more than double THE RATE OF INCREASE OF the global..." [Government of United States of America]
6434	SPM	5	48	5	48	It seems that the use of likely to describe the fact that the Arctic surface air temperature has warmed twice as fast at the global average does not jive with the high confidence at the end of the sentence. Reconcile by stating very high confidence. [Government of United States of America]
4644	SPM	5	48	5	50	Suggested changes in the uncertainty qualifiers: 'Arctic surface air temperature has likely increased by more than double the global average over the last two decades (high confidence) , with feedbacks from loss of sea ice and snow cover contributing to the amplified warming (medium confidence)' [Government of Russian Federation]
1416	SPM	5	48	6	3	Potential effects on lower latitude weather should be caught in overall finding A2. [Government of Denmark]
7808	SPM	5	48	6	3	See our general comment on warming/ temperature metrics. Fine to discuss Arctic Surface Air Temperature, but the reader also needs to understand how to interpret this information in the context of headline temperatures for global warming, which are mainly based on GMST. [European Union]
1048	SPM	5	49	5	49	Suggest clarification: "... average increase over the last two decades.” [Government of Australia]
4840	SPM	5	49	5	49	pls insert: ...from e.g. loss of..., because there are still other feedbacks water vapour, cloudiness etc. (p. 3-11) [Government of Germany]
4842	SPM	5	50	5	50	term (high confidence) is not identified in the original text (p. 3-11) [Government of Germany]
8402	SPM	5	50	5	52	What is the value in the SPM of two individual year's observations? [Government of New Zealand]
7810	SPM	5	51			not "very unusual", but "extremely unusual" [European Union]
4632	SPM	5	51	5	52	How increased winter temperatures in the central Arctic may impact thick multi-year ice there, even "contributing to sea ice absense"? A very strange setntense. [Government of Russian Federation]
4844	SPM	5	52	5	52	term (high confidence) is not identified in the original text (p. 3-11) [Government of Germany]
4846	SPM	5	52	6	2	Please briefly describe the mechanism of this long-range and long-lasting effects to make this information useful for a non-expert audience. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3164	SPM	5	52	6	3	The statement here appears stronger than the underlying assessment cited. Box 3.2 includes the statements 'There is only low to medium confidence in the current nature of Arctic/mid-latitude weather linkages because conclusions of recent analyses are inconsistent' and 'Overall, changes in the stratospheric polar vortex and Northern Annual Mode are not separable from natural variability, and so cannot be attributed to greenhouse gas forced sea ice loss (Screen et al., 2018).' Recommend adding the latter sentence to the SPM, to indicate that while there is the theoretical possibility of a linkage between sea ice loss and the jet/stratospheric vortex, it has not been demonstrated in observations. [Government of Canada]
4848	SPM	5	52	6	3	We welcome the inclusion of potential influence of loss of sea-ice on weather outside the Arctic. Still, it would be helpful for policymakers if the consequences were spelled out more clearly. Can the potential effects of "influencing the position and strength of the tropospheric jet stream and the stratospheric polar vortex" be described in more accessible terms? [Government of Germany]
7430	SPM	5	52	6	3	Regarding the SPM A2.3 that mentions the Arctic sea ice reduction trend, it seems that policy makers would also be interested in the policy-relevant long-term trend related to sea-ice-forced teleconnection that have been detected in the climate outside the Arctic region, since the Arctic sea ice extent has been reduced and will continue to decline in the coming decades. The current description on the timescales of weeks to months would seem to give a somewhat sudden impression to readers. We understand that it would not be easy to mention such kind of trend, since the Box 3.2 assesses the potential for the sea ice loss in the Barents and Kara Seas to drive cold episodes in eastern Asia as being only episodic. However, the latest research (Mori et al., 2019: reconciled estimate of the influence of Arctic sea-ice loss on recent Eurasian cooling, Nature Climate Change 9, 123-129) has pointed out that the importance of such teleconnection has remained controversial because the climate models underestimated the sea-ice-forced signal. Thus, it would be much appreciated if there could be an assessment of the long-term climate trend in the extra-Arctic regions by referring to the latest complementary research findings. [Government of Japan]
4306	SPM	6	1	6	2	I would think that this would warrant a bit more explanation, in particular as to what 'influencing' would mean and translate into. [Government of Monaco]
4850	SPM	6	1	6	2	It would be helpful for improved understanding to add some examples how the weather could possibly be affected. [Government of Germany]
7566	SPM	6	2			The terms "tropospheric jet stream" and "stratospheric polar vortex" are not easy for all readers to understand and they have not been included in the glossary. Is it possible to clarify what they mean? [Government of Finland]
4852	SPM	6	2	6	2	The original chapter text states "...polar vortex (low to medium confidence)". (p. 3-16), please check for consistency and revise. [Government of Germany]
574	SPM	6	5	6	10	is it possible to slightly refine and provide the relative role of SST and SSS? [Government of France]
2678	SPM	6	5	6	10	It may not be clear to a non-expert what is mean by 'high latitude freshening' - could this be briefly defined? [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4856	SPM	6	5	6	10	A2.5 The first sentence claims that change in stratification has impacted oxygen, nutrients and net primary production NPP. We find no traceable account for this statement in the report (see below). While it is clear from process understanding, that stratification will influence O, nutrients and NPP, the statement refers to observations - but evidence is less clear for those changes having occurred. One could add a "potentially impacting nutrients and NPP", or a similar formulation, indicating that stratification has been observed, but the impacts for nutrients and NPP have not been observed / attributed as of yet. Oxygen: Ch5-ES states: "There is a growing consensus that the open ocean is losing oxygen overall with a very likely loss of 0.5 to 3.3% between 1970-2010 from the ocean surface to 1000 m (medium confidence). Globally, the oxygen loss due to warming is reinforced by other processes associated with ocean physics and biogeochemistry, which cause the majority of the observed oxygen decline (high confidence). The oxygen minimum zones are expanding by a very likely range of 3-8%, most notably in the tropical oceans, but there is substantial decadal variability that affects the attribution of the overall oxygen declines to human activity in tropical regions (high confidence). {5.2.2.4.}" although the stratification change is very likely, the impact on oxygen needs "medium confidence" Nutrients and NPP statement: not traceable in Chapter 5: Page 36 Ch5: „There is limited evidence on contemporary trends in nutrient levels, either from time-series sites or broader meta-analyses. Increasing inputs of anthropogenic nitrogen from the atmosphere are perturbing ocean nutrient levels." Page 37 Ch5: Since AR5, a variety of studies have reported relatively insignificant changes in overall open ocean chlorophyll levels of < ±1% yr–1 for individual time periods …Overall, there is low confidence in satellite-based trends in global ocean NPP due to the time series length and lack of corroborating in situ measurements or other validation time series. This is especially true at regional scales where distinct sets of poorly understood processes dominate. [Government of Germany]
6440	SPM	6	5	6	10	This paragraph does not describe the signficance of observed increases in stratification. Are there any observed impacts of such increases? [Government of United States of America]
6442	SPM	6	5	6	10	A2.5 should also include the polar regions symbol (snowflake) since, high-latitude freshening is specifically called out in this key message. [Government of United States of America]
7812	SPM	6	5	6	23	A2.5 &v A2.7 are inaccessible to non-experts and thus policymakers. A2.1 already tells us that the upper layers have shown greater warming. In order to be policy relevant, these statements need to explain more directly why increased stratification matters (see also general comment about re-ordering A&B statements so that observations and projections are placed together). [European Union]
570	SPM	6	5	6	5	Please specify the definition of "upper ocean" in this context. The assessment in chapter 5 specifies that the increase in stratification is for the 0-200m depth layer. It is very important to specify this in the SPM, because the sentence here is misleading. [Government of France]
1418	SPM	6	5	6	5	Add polar icon. Freshening of upper ocean layer and increased stratificatrion is pronounced in the Arctic. [Government of Denmark]
4854	SPM	6	5	6	5	Please add an explanation in brackets what stratification is, as has been done for marine heat waves in line 33 (page SPM-5). [Government of Germany]
6436	SPM	6	5	6	5	Should this be "…upper ocean since AT LEAST 1970…" or "…FROM 1970 TO THE PRESENT,…" ? [Government of United States of America]
1392	SPM	6	5	6	6	If the impact in all three cases is a decrease, suggest to use "decreasing" instead of "impacting". The word impact alone does not convey much information. [Government of Denmark]
6438	SPM	6	5	6	6	"nutrient supply" is not well defined here. Exogenous supply will not change due to stratification. "Nutrient cycling" is impacted greatly. [Government of United States of America]
4858	SPM	6	6	6	6	Concerning the nutrient supply and net primary production there seems to be no measurable evidence in chapter 5 of the report. Why is it equally ranked then with oxygen? Please revise. [Government of Germany]
6444	SPM	6	6	6	6	KEY ISSUE [JARGON]: Will the policymakers reading this summary have enough of a technical background to understand what net primary production is and why it is important? If there's any uncertainty as to how much earth science jargon they know, suggest providing a brief definition of NPP as NPP recurs throughout the report as an important concept. [Government of United States of America]
572	SPM	6	6	6	8	Please consider reminding the role of temperature and salinity in the stratification and density of water masses. The sentence « observed surface ocean warming and high latitude freshening are making the surface ocean less dense » would then become clearer for policymaker. [Government of France]
4064	SPM	6	6	6	8	Please consider adding a few words explaining why mixing is important for the arctic ecosystem, e.g. spring bloom. [Government of Norway]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4066	SPM	6	6	6	8	Please consider inserting the reason for high latitude freshening [cause by ….] are making the surface … etc. [Government of Norway]
6446	SPM	6	7	6	7	"…deeper water layers in the ocean…" Insert "water layers". [Government of United States of America]
1192	SPM	6	7	6	8	The level of confidence given to the finding in this sentence is expressed as "high confidence". However, Chapter 5 of the underlying report states that Figure 5.5 represents only a model result, with only one data EN4 used for the observation, while Figure 5.3 uses only one reanalysis data SODA. Therefore, the expression of "high confidence", which is not supported, is suggested to be checked. [Government of China]
576	SPM	6	8	6	10	Please consider clarifying this sentence. What does an increase in stratification by x% means (x% of what ?)? Are there different definitions of stratification? If yes, it should be added after % "when expressed in Squared Buoyancy Frequency" [Government of France]
4308	SPM	6	8	6	10	What an increase in stratification by x% means? [Government of Monaco]
7432	SPM	6	8	6	10	Please check “The spatial- and multi-year-mean stratification of the upper 200 m very likely increased by 2.30 ± 0.12% between the 1971 – 1990 average and the 1998 – 2017 average.” (“The upper 200 m stratification increase is in the very likely range of between 2.18% and 2.42% from1970 to 2017.” in page 5 – 4 of Chapter 5) [Government of Japan]
1050	SPM	6	8	6	8	Suggest the statement about "inhibiting mixing" needs a link/reference to section A2.7 to show relationship. [Government of Australia]
1194	SPM	6	9	6	10	The upper 200 m average stratification was strengthened by 2.3+/-0.12% in 1971-1990. The confidence interval of "very likely" is given. However, the result is based on only one observational data (EN4 data, chapter-5/p54). In the EN4 data paper (Good et al. 2013), it is directly stated that EN4 data, the analysis field of which tends to deviate from the climatic mean state, is not suitable for estimating the long-term trend of ocean change. However, the systematic deviation of data, a problem that makes the data itself unsuitable for being taken up in the assessment, is not taken into account in this process. It is suggested that a check and revision be made. Good, S. A., M. J. Martin, and N. A. Rayner (2013), EN4: Quality controlled ocean temperature and salinity profiles and monthly objective analyses with uncertainty estimates, J. Geophys. Res. Oceans, 118, 6704–6716, doi:10.1002/2013JC009067. “[29] It is important to note that the analyses will relax to climatology in the absence of any observations. Care must therefore be taken if using the analyses for applications such as identifying trends in temperature or salinity, because a trend may be unrealistic if analyzing periods when there were no observations.” [Government of China]
4860	SPM	6	9	6	10	The information on the stratification needs context so that the reader can understand the dimension and significance of change. Please revise. [Government of Germany]
6448	SPM	6	9	6	9	Change to "…multi-year-mean VERTICAL stratification…" [Government of United States of America]
3166	SPM	6	12	6	12	Add “emitted” before “anthropogenic carbon”, to clarify that the ocean has taken up carbon emitted by human activity to the atmosphere. [Government of Canada]
4862	SPM	6	12	6	12	pls add a sentence under A2.6 or insert an additional para to characterize the role of the global ocean as a Carbon-sink, e.g.: Multiple datasets and models show that the role of oceans uptake of atmospheric CO2 has continued to strengthen in the recent two decades in response to its increasing concentration in the atmosphere (p.5-3). CO2 uptake from the atmosphere has increased from around 1.2 ± 0.5 Pg. C/y (early 1980s) to 2.0 ± 0.5 Pg. C/y in 2010-2015 (p. 5-27). Please also consider to use Gt CO2 instead of PgC, and revise the second sentence to read: "…uptake has roughly doubled betweem the early 1980s to 2010-2015, from around…" [Government of Germany]
4090	SPM	6	12	6	13	Consider clarifying that acidification is mainly related to human CO2 emissions as oposed to climate change which is caused by several greenhouse gases. e.g use language from 3.2.1: We propose to change the text after 20-30 % to: carbon dioxide (CO2) released by human activities since the 1980s, causing further ocean acidification."is taken up by the oceaninsert "dioxide emissions" after "anthropogeninic carbon". [Government of Norway]
6450	SPM	6	12	6	13	The use of the word "further" is confusing in this sentence. Is it further in time, space, or in addition to natural background? Since pre-1980 ocean acidification and CO2 uptake by the ocean haven't been mentioned, strike the word "further". [Government of United States of America]
7700	SPM	6	12	6	13	ocean takes up carbon, without distinguishing between the anthropogenic one and the natural one, therefore, we ask for redrafting this sentence, as it can be missunderstood. [Government of Spain]
6452	SPM	6	12	6	14	There is disagreement within this statement. Is it virtually certain or very likely? [Government of United States of America]
2698	SPM	6	12	6	16	Suggest that this section also includes the policy relevant text from Chapter 5 (pg 5-4) "Changes in pH have reduced the stability of mineral forms of calcium carbonate….most notably in the upwelling and high latitude regions of the ocean". [Government of United Kingdom (of Great Britain and Northern Ireland)]

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3168	SPM	6	12	6	16	A2.6:"very likely" is not accurate when applied to the specific numeric range given (20-30%). What is the statistical basis for this assertion? While it is virtually certain that the ocean has taken up something on this order, the probability that it is >30% is higher than implied here. [Government of Canada]
6454	SPM	6	12	6	16	"it is likely that…95% of the ocean area" Where has the 95% come from? [Government of United States of America]
7814	SPM	6	12	6	23	Impacts of ocean acidification and loss of oxygen could be included, in particular the effects on biodiversity. [European Union]
2680	SPM	6	13	6	13	Should this be 'carbon dioxide' as opposed to 'carbon', as carbon could be taken to mean other forms of carbon such as methane? [Government of United Kingdom (of Great Britain and Northern Ireland)]
2694	SPM	6	13	6	13	"causing further ocean acidification" - this is the first reference of OA, suggest remove 'further' or add some clarification i.e. 'since the preindustrial era' [Government of United Kingdom (of Great Britain and Northern Ireland)]
3450	SPM	6	13	6	13	"Further" compared to what? [Government of Sweden]
8288	SPM	6	13	6	13	Suggest "carbon" is replaced with "carbon dioxide" [Government of New Zealand]
4092	SPM	6	13	6	14	Changes in pH units do not tell most policymakers very much. Please consider stating the percentage increase in acidification too. [Government of Norway]
4864	SPM	6	13	6	16	The units for pH can look minimal (0.017 to 0.027 pH units per decade), can this be put into perspective? Also, please resive the statement in lns 14-16, it is currently not clear to us whether this means that some parts of the Ocean have remained unaffected, or whether models/observations are lacking. [Government of Germany]
6456	SPM	6	13	6	16	The first statement about Ocean Acidification reads: "A2.6 It is very likely that the ocean has taken up between 20-30% of total anthropogenic carbon since the 1980s, causing further ocean acidification (virtually certain). Open ocean surface pH has declined by a very likely range of 0.017 to 0.027 pH units per decade since the late 1980s. This decline means that it is very likely that the near surface ocean acidification signal has already emerged from the background natural variability for more than 95% of the ocean area." Yet, on page SM5-6 of the Chapter 5 supplementary material (Table SM5.3), the pH range is from 0.013 to 0.044. The summary must change to reflect the data in Table SM5.3. [Government of United States of America]
2664	SPM	6	14	6	14	This change in pH equates to how much of a change in acidity? 3x is often quoted in the OA literature. Suggest this is added to clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
578	SPM	6	14	6	16	This sentence should be rephrased to be clearer and understandable by policymakers. We suggest something like: "It is very likely that for more than 95% of the ocean aera, the observed near surface ocean acidification signal is larger than natural variability." [Government of France]
2682	SPM	6	14	6	16	The statement that 'the near surface ocean acidification signal has already emerged from the background natural variability' is unclear - does this refer to the rate of pH change, or the absolute change? This could rephrased to 'ocean pH has decreased more/decreased faster than could be attributed due to natural variability' for clarification? [Government of United Kingdom (of Great Britain and Northern Ireland)]
5996	SPM	6	16	6	16	For Policymakers who is not a specialist in climate change, "background natural variability" is a difficult term, even if it is correct term in respect of climate change science. To ensure that most policymakers understand this SR, this term needs to be replaced by "variability in normal conditon", "natural variability" or other better words. [Government of Republic of Korea]
2674	SPM	6	18	6	19	0.5 to 3.3%. Is this a range associated with uncertainty, or a range of observed oxygen loss from the surface to 1000m deep. Suggest this is clarified in the text. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2684	SPM	6	18	6	23	A2.7 has a number of technical terms that may not be clear to a non-expert, including stratification, ventilation, biogeochemistry and oxygen minimum zones. These should be explained. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3170	SPM	6	18	6	23	A2.7: It is not clear exactly what the "(high confidence)" at the end refers to. [Government of Canada]
4120	SPM	6	18	6	23	What are the impacts on the ecosystem of declinging oxygen concentration? At which level will it be dangerous? Please consider elaborating on this. [Government of Norway]
6458	SPM	6	18	6	23	This paragraph does not describe the signficance of observed decreases in ocean oxygen and increases in OMZs. Are there any observed impacts of these changes? [Government of United States of America]
3172	SPM	6	18	6	24	A2.7 states “The oxygen minimum zones are likely expanding by 3-8%” – this statement is unclear as to whether the expansion is a rate per year or the difference between to the years given earlier in this paragraph (1970 and 2010). [Government of Canada]
7818	SPM	6	19			The oxygen loss is due primarily "to" (instead of "through") [European Union]
580	SPM	6	19	6	19	Please consider substituting "through" by "to" [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3642	SPM	6	19	6	19	Replace "1000m" with "1000 m" [Government of Brazil]
6460	SPM	6	19	6	19	Should say "to" not "through". [Government of United States of America]
7816	SPM	6	19	6	19	Change "from the surface to 1000m" to "upper 1000m" [European Union]
8290	SPM	6	19	6	20	The sentence would read better with a slight re-ordering: Change "The oxygen loss is due primarily through changing ocean stratification" to "The oxygen loss is primarily due to changing ocean stratification" [Government of New Zealand]
584	SPM	6	19	6	21	l.19-21 : Please consider deleting the end of this sentence as it is currently not clear. The part "reinforce the smaller contribution" does not add important information and is confusing [Government of France]
3174	SPM	6	19	6	21	For readers, being clear about the direction of change is preferable. Therefore, suggest rewriting this sentence to report on the direction of changes: “the oxygen loss is due primarily to increased ocean stratification, decreased ventilation, and altered biogeochemistry, which reinforce the smaller contribution due to reduced oxygen solubility in warmer ocean water.” [Government of Canada]
4866	SPM	6	19	6	21	Difficult sentence to understand: Suggested rewording: The oxygen loss is primarily due to changes in ocean stratification, ventilation and biogeochemistry. This reinforces the smaller contribution of the reduced solubility from warming to oxygen loss (high confidence). [Government of Germany]
6462	SPM	6	19	6	21	If the processes of changing ocean stratification/ventilation/biogeochemistry are independent from reduced solubility from warming, suggest replacing "reinforce" with "in addition to" to avoid confusion about their interaction. [Government of United States of America]
582	SPM	6	20	6	20	"biogeochemistry": please clarify (increase in primary production, carbon export ?) [Government of France]
2696	SPM	6	20	6	21	Suggested addition to text: "Which reinforce the smaller contribution due to reduced oxygen solubility from warming" - to clarify for policy readers [Government of United Kingdom (of Great Britain and Northern Ireland)]
6464	SPM	6	20	6	21	Reword "…reinforce the smaller contribution due to reduced solubility from warming…" to "…reinforce the smaller contribution by warming, which reduces solubility…" for readability. [Government of United States of America]
3454	SPM	6	21	6	21	The meaning of the confidence statement is unclear. Is the idea here that there is an effect of natural variability on attribution feasibility? This would not seem to add very much to the already stated "likely" finding that reflects a certainty-level. [Government of Sweden]
4868	SPM	6	21	6	21	pls. revise: (high confidence) in (medium confidence) and 'likely' in 'very likely' (p. 5-32) to be consistent with the underlying chapter. [Government of Germany]
6466	SPM	6	21	6	21	Change "are expanding" to "have expanded". [Government of United States of America]
7436	SPM	6	21	6	21	What kind of zones are “oxygen minimum zones”? Is it better to provide some explanation about them. [Government of Japan]
586	SPM	6	21	6	22	"The oxygen minimum zones are likely expanding by 3-8%," For which period of time? (or is it per decade?) [Government of France]
3178	SPM	6	21	6	22	although implied as the time frame from 1970-2010, it would be good to specify the time frame for the 3-8% expansion. [Government of Canada]
3644	SPM	6	21	6	22	The oxygen minimum zones are likely expanding by 3-8 % during which period? From 1970 to 2010? [Government of Brazil]
7434	SPM	6	21	6	22	Please check “The oxygen minimum zones are likely expanding by 3 – 8%likely” (“The oxygen minimum zones are expanding by a very likely range of 3 – 8%” in page 5 – 4 Chatter 5) [Government of Japan]
2700	SPM	6	21	6	23	This section tells us that oxygen minimum zones are expanding by 3-8%. It is it possible to clarify what timeframe this is happening/has happened over? Are projections available for change to oxygen minimum zones over the 21st Century? Suggest this is added to section B if available. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3176	SPM	6	21	6	23	Change “are likely expanding by 3-8%” to “have likely expanded from 3-8%”. Observations are from the historical time period. [Government of Canada]
4140	SPM	6	21	6	23	It is unclear to us what time-interval the expansion of oxygen minimum zones by 3-8% is refering to. Please consider elaborating on this. [Government of Norway]
4310	SPM	6	21	6	23	For which period of time? (or is it per decade?) [Government of Monaco]
8624	SPM	6	21	6	23	It is not necessarily clear to the uninitiated reader what exactly an “oxygen minimum zone” is (not a commonly used term). The authors may want to consider offering a definition. [Government of Netherlands]
3452	SPM	6	22	6	22	What is the reference period / over which period do the 3-8% refer to? [Government of Sweden]
6468	SPM	6	22	6	22	3-8% needs a time frame qualifier. [Government of United States of America]
6470	SPM	6	22	6	22	Can something more descriptive than "affects" be chosen? "complicates" perhaps? [Government of United States of America]
8604	SPM	6	22	6	22	Not clear over which time period the oxygen minimum zones are expanding by 3-8% [Government of Netherlands]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6472	SPM	6	22	6	23	"The oxygen minimum zones are likely expanding by 3-8%, most notably in the tropical oceans, but there is substantial decadal variability that affects the attribution of the overall oxygen declines to human activity in tropical regions" is awkward and doesn't come across as objective. Variability doesn't "affect attribution." [Government of United States of America]
7820	SPM	6	22	6	23	The word 'affects' is ambiguous. Suggest rephrasing [European Union]
2692	SPM	6	25	6	25	It would be helpful if the timespan of available modern observations could be defined, perhaps by a starting year in brackets. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6474	SPM	6	25	6	25	"model simulations" -- insert the word 'model'. [Government of United States of America]
4156	SPM	6	25	6	28	A2.8: Refering to IPCC 1,5 degrees: "There is only limited evidence linking the current anomalously weak state of AMOC to anthropogenic warming (Caesar et al., 2018)." Please consider emphasising this lack of linking in this section as well. [Government of Norway]
6476	SPM	6	25	6	28	KEY ISSUE [JARGON]: Define AMOC. Explain to policymakers why a potential weakening of AMOC is important and why they should be worried about potential consequences/impacts. A later section goes into AMOC in more detail, but context needed at first mention. [Government of United States of America]
6478	SPM	6	25	6	28	A2.8 should include the polar regions symbol (snowflake) because important deepwater formation occurs in the Arctic (poleward of 60N). [Government of United States of America]
7438	SPM	6	25	6	28	As it has been a hot issue among oceanographers whether the weakening trend of the Atlantic Meridional Overturning Circulation (AMOC) is detectable or not, if a consensus has been reached that it is indeed detectable, that would seem as a significant progress since AR5. Thus, it seems highly appropriate that this finding would also be mentioned in the headline in Section A, for instance in A2, in addition to being mentioned in B2. [Government of Japan]
7822	SPM	6	25	6	28	Some mentioning on the impacts of a weakened AMOC or some background on the AMOC role on climate and temperature regulaiton in the ocean could present better the relevance of mentioning it. [European Union]
1052	SPM	6	26			Suggest inserting "era" after "preindustrial". [Government of Australia]
6480	SPM	6	26	6	26	Add "period" or "era" after "preindustrial". [Government of United States of America]
7824	SPM	6	26	6	26	"since the preindustrial" should read "since the preindustrial era" [European Union]
8478	SPM	6	27	6	28	To shorten the SPM, we suggest the second sentence in this paragaph could be deleted. Policymakers probably don't need this information as the first sentence provides a clear enough message as is. [Government of Canada]
3180	SPM	6	30			Replace 'global sea level' with 'global mean sea level'. Relative sea level is decreasing at some locations. [Government of Canada]
1054	SPM	6	30	6	30	Suggest replacing "is accelerating" with "has been accelerating". [Government of Australia]
6482	SPM	6	30	6	30	Split A3 into two sentences. The first should focus on the global mean and its causes. The second should mention the existence of regional variations. [Government of United States of America]
6484	SPM	6	30	6	30	Invoking regional variability in the first sentence complicates an already long sentence. The reference to regional variability should be removed from the first sentence and added to a subsequent sentence. Propose the following: "A3. Global mean sea level is rising at a rate that is accelerating in recent decades (virtually certain) due to increasing rates of ice loss from the Greenland and Antarctic ice sheets, and from thermal expansion due to ocean warming (high confidence). Regionally, sea levels vary by ±30% around the rising mean due to non-uniform ocean heating, ocean dynamics and land ice loss (high confidence). {3.3, 4.2, 6.2, 6.3, 6.7, 6.8, Figures SPM.1, SPM.2}" [Government of United States of America]
8292	SPM	6	30	6	30	Insert "at" before "a rate that" such that the sentence reads "...and at a rate that is accelerating...." [Government of New Zealand]
8404	SPM	6	30	6	30	"accelerating" can be interpreted to mean a constant (quadratic) acceleration, which is unhelpful. Consider using "increasing" or "getting faster" (since "increasing: is already used in that sentence) [Government of New Zealand]
8542	SPM	6	30	6	30	Why is the 'virtually certain' qualifier needed for the statement that "global sea level rising"? Why not given as a statement of fact as it was in AR5 WGI headline statement? Is there some remaining statistical uncertainty in the global trend? [Government of Switzerland]
588	SPM	6	30	6	33	Please consider emphazing that A3 deals with the acceleration of global sea level rise, and is complementary to A1. We suggest rephrasing as "The rate of global sea level rise is accelerating with regional variations. This rate is accelerating due to" [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
1196	SPM	6	30	6	33	In A3. “Global sea level is rising (virtually certain) with regional variations and a rate that is accelerating in recent decades due to increasing rates of ice loss from the Greenland and Antarctic ice sheets, and from thermal expansion due to ocean warming. (high confidence)”, the contribution of glaciers is not mentioned. It is suggested to add glacier related information by referring to the relevant finding in the Executive Summary of Chapter 4 on page 3 of the underlying report that “Global mean sea level (GMSL) is rising (virtually certain) and accelerating (high confidence). The sum of glacier and ice sheet contributions is now the dominant source of GMSL rise (very high confidence).” [Government of China]
1338	SPM	6	30	6	33	Please provide absolute numbers of sea level rise in this headline statement. [Government of Luxembourg]
3182	SPM	6	30	6	33	There are too many messages packed into the first sentence. Suggest removing the message about regional variations in sea level rise. Either exclude or put in a separate sentence. Also, use past tense for the results presented here (“has risen”, “has accelerated”). [Government of Canada]
6048	SPM	6	30	6	33	Just a thought and something to be researched and considered in depth, in this paragraph, authors claim that the acceleration of sea level rising is increasing, but I wonder what happened to the evaporation rate from sea, does it change or kept subtle since the global temperature is increasing!! [Government of Saudi Arabia]
6486	SPM	6	30	6	33	The reference to 6.7 in the A3 summary probably is linking to A3.6, but it is not obvious what in 6.7 is being cross-referenced. No clear AMOC weakening trend has yet to be linked to anthropogenic climate change. AMOC variability could induce "extreme sea level events" -- one of which is mentioned in Chapter 6 (page 6-48, paragraph starting with "changes in ocean circulation" -- but these changes have not been attributed to anthropogenic climate change. Therefore, it is not appropriate to refer to 6.7 in A3 and A3.6. [Government of United States of America]
8672	SPM	6	30	6	33	Simplify text and add conclusion from A3.4 to "Global sea level is rising (virtually certain) and accelerating (high confidence) due to increasing rates of ice loss from the glaciers of Greenland and Antarctic ice sheets, and from thermal expansion due to ocean warming (high confidence). Climate change has increased observed precipitation, winds and extreme sea level events associated with a number of cyclones (high confidence)" [Government of Netherlands]
1424	SPM	6	30	7	16	Suggested order of key finding: A3, A3.4, A3.1, A3.2 [Government of Denmark]
2688	SPM	6	30	7	16	The attribution of sea level rise could be presented more clearly throughout A3, which often only mentions attribution when we are unable to attribute processes to anthropogenic warming. While there are clearly challenges, for example from attribution of ice sheet melt, the underlying report clearly states that "The dominant cause of global mean sea level rise since 1970 is anthropogenic forcing (high confidence)" (Chapter 4, executive summary, p4-3). Suggest that this message is clearly stated in the summary for policymakers. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2690	SPM	6	30	7	16	A key question that may emerge from A3 is how much have sea levels already risen, especially as the SPM discusses future SLR. A3 does not currently address this but states the rate of change. This could be added using text from the underlying report - "On this basis, we estimate that it is very likely that the long-term trend in GMSL estimated from tide gauge records is 1.5 [1.1–1.9] mm yr–1 between 1902 and 2010 for a total sea level rise of 0.16 [0.12–0.21] m" (section 4.2.2.1.1, p4-19) [Government of United Kingdom (of Great Britain and Northern Ireland)]
7826	SPM	6	32			What does the "high confidence" apply to? To the acceleration? To the attribution (to rates of loss and thermal expansion)? [European Union]
4872	SPM	6	35			Please use the term acceleration instead of „the combined rate has increased“. [Government of Germany]
2666	SPM	6	35	6	35	Suggested addition to text: 'has increased over time' [Government of United Kingdom (of Great Britain and Northern Ireland)]
2672	SPM	6	35	6	35	The combined rate of ice loss from the Greenland and Antarctic ice sheets has increased' - since when? Is 1992 our first record or do observations extend any further? Please clarify if possible. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1420	SPM	6	35	6	38	The recent SLR contribution from ice sheets and glaciers is around 2 mm/year. This implies that almost 2/3 of yearly current average isostatic SLR (3,2 mm according to AR5) comes from ice sheets and glaciers. The contributions has accelerated over the last decades and are now greater than the global yearly rise of 1,7 mm pr. year over the previous century (1901-2010 AR5). [Government of Denmark]
3456	SPM	6	35	6	38	Combining likelihood and confidence level statements should be avoided, as the meaning becomes very unclear. [Government of Sweden]
4870	SPM	6	35	6	38	Subsection A1.1 and A3.1 provide similar information, please combine and shorten. Also, it is unclear why A1.1 provides confidence statements even for general statements while A3.1 uses likelihood language in combination with confidence language also for general statements. Please clarify. [Government of Germany]
7828	SPM	6	35	6	38	Assignments of probability and confidence should be either always in brackets or always without brackets. In this example: “Mas loss from the ice sheets in 2012-2016 was likely higher than in 2002-2011, and several times higher than in 1992-2001 (extremely likely, high confidence)”, we automatically give less importance to what is in brackets (visually this information is secondary, a clarification). So the word “likely” inevitably pollutes the second assertion too – it is the way we process visually the bracketed information. [European Union]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6488	SPM	6	36	6	36	The word "likely" should be italicized if it refers to the IPCC calibrated language. If not, avoid using the word "likely," as it can be confusing. [Government of United States of America]
2676	SPM	6	36	6	37	"was likely higher…" likely is unecessary as the level of certainty is included at the end of the sentence in brackets [Government of United Kingdom (of Great Britain and Northern Ireland)]
6490	SPM	6	36	6	37	Make the rate of mass ice loss over the different time periods more explicit. [Government of United States of America]
2668	SPM	6	37	6	37	can 'several times' be made more explicit - e.g. how many times higher approximately? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7702	SPM	6	37	6	37	the term "several times higher" doesn't look very scientific. Please, specify how many times or delete. [Government of Spain]
8216	SPM	6	40	6	40	they should not be called "glaciers" but "ice streams" or "ice sheet outlet glaciers" (see AR5 Glossary) [Government of Austria]
1198	SPM	6	40	6	41	“Acceleration of glacier flow, leading to rapid mass loss, is observed in the Amundsen Sea Embayment of West Antarctica and in Wilkes Land, East Antarctica”. The meaning of "glaciers" in this finding is not clear. In some cases, "glaciers" includes "ice sheets". It is suggested that the footnote on page 2 clarify that "glacier" in the SPM refers specifically to the glaciers that do not involve Antarctic or Greenland ice sheets. [Government of China]
2686	SPM	6	40	6	44	Suggest that it would be useful if A3.2 puts in context the potential consequences of irreversible retreat linked with the onset of the Marine Ice sheet Instability process e.g. the contribution to sea level rise, as a non-expert may not make this link. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4874	SPM	6	40	6	44	We'd appreciate a more in-depth assessment of the potential onset of MISI here. We know that risk scales with temperature, a number of studies were published that show instability, this is new as compared to AR5 - therefore it should be explained here. Is confidence in MISI occurring really low? [Government of Germany]
6050	SPM	6	40	6	44	Why such data was not available at this particular area?! [Government of Saudi Arabia]
4876	SPM	6	40	6	45	To support the narrative and understanding please consider to add a short sentence, why ice flow processes are relevant for SLR. [Government of Germany]
3184	SPM	6	41	6	44	As written, it is unclear what the low confidence is attached to. The phrase “low confidence in assessing whether…..” is awkward and unclear. Recommend instead phrasing such as “There is low confidence that these observed changes are the beginning of irreversible retreat….” OR if more appropriate, phrasing such as “ it is not yet possible to conclude whether or not these changes are the beginning of irreversible retreat….”. [Government of Canada]
4206	SPM	6	41	6	44	Please consider explaining/using language that is easier to understand for "Marine Ice Sheet Instability Processes" -- is this not rapid ice loss? [Government of Norway]
4536	SPM	6	42	6	43	It is not only insufficient observational data and models not representing ice flow processes adequately that limits the confidence in onset of MISI. Uncertainties in forcing (and in particular changes in ocean circulation) also play a major role. We suggest reformulating this for more clarity about the origin of the low confidence and modeling difficulties (to clarify which model / processes involve knowledge or modeling limitations). [Government of Belgium]
5998	SPM	6	44	6	44	Is 'Marine Ice Sheet Instability process' too technical for SPM? Consider using rather plain words. [Government of Republic of Korea]
3186	SPM	6	46		49	The statement that the rate of ocean warming has more than doubled since 1993 is inconsistent with the following sentence for the 0-700m layer, for which the rate of warming was less than double over 1993 to 2017 versus 1979-1993. [Government of Canada]
6492	SPM	6	46	6	46	There is value in assigning different likelihoods to each range and to mention the reason there is less confidence about the increase in warming rates below 700 -- i.e., because of fewer observations. It seems like the likelihood rating assigned to the current formulation is the one for 700-2000m. If you parsed this to split out 0-700m and 700-2000m, authors could use the term "very likely" for the 0-700m ocean section. Given the rapid changes in ocean ecosystems due to climate change, leading with high likelihood statements is really important for accurately conveying what is happening. [Government of United States of America]
7442	SPM	6	46	6	47	“The ocean warmed by nn ZJ” could be modified like “The ocean heat uptake rate was nn ZJ” for more clarity. [Government of Japan]
1200	SPM	6	46	6	48	The Executive Summary and the body text of Chapter 5 of the underlying report are inconsistent in formulating the same finding. As stated in the Executive Summary of Chapter 5 on page 3 of the underlying report, the time period of the finding is "1970-1993", with the unit being "ZJ", while in Table 5.1 on pages 14-15 of the underlying report text, the time period of this finding is "1969-1993", with the unit being "ZJ yr-1". It is the data in the body text that is cited in the SPM. It is suggested that the time period of the finding and the expression of the unit be checked for a general revision. [Government of China]

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3646	SPM	6	46	6	48	Replace "0-700m" with "0-700 m" and "700-2000m" with "700-2000 m" [Government of Brazil]
4878	SPM	6	46	6	48	Paragraph A3.3 is difficult to understand. Suggest rewording less academically. [Government of Germany]
7440	SPM	6	46	6	48	It may be better to use the consistent period in SPM A3.3 (“1969 to 1993”), the Executive Summary of chapter 5 (“1970 to 1993”) and the Table 5.1 of underlying chapter 5 (“1969 to 1993”). [Government of Japan]
1340	SPM	6	46	6	49	Section A3.3: This section could be combined with section A2.1 and the figure of ZJ converted to degree centigrade as in section A2.1 [Government of Luxembourg]
1422	SPM	6	46	6	49	Merge with section A2.1 and simplify. Scale to heat uptake to something imaginable. [Government of Denmark]
3794	SPM	6	46	6	49	The unit of warming is degree C: The numbers are on energy: This information on the energy uptake by oceans should be in a high level statemement [Government of Ireland]
4228	SPM	6	46	6	49	If possible, please consider giving the reader (policymaker) an illustration/picture of how much energy this is in addition to ZJ-numbers? And maybe also explain what ZJ is. [Government of Norway]
4230	SPM	6	46	6	49	There are regional differences in the amount of ocean warming between the different oceans. Please consider including a sentence about this. E.g. about how the Arctic and Southern Ocean are warming individually in addition to the global average. [Government of Norway]
4312	SPM	6	46	6	49	Very similar to A2.1 [Government of Monaco]
4880	SPM	6	46	6	49	This statement should be moved to A2 and combined with A2.1. It is odd to have two separate statements on ocean warming rates in the SPM in separate sections. [Government of Germany]
4882	SPM	6	46	6	49	Rates of heat uptake are used as warming rates! Pls. delete "warming" and insert "heat uptake" (5.14) or describe ocean's warming simply by increasing temperatures [Government of Germany]
4884	SPM	6	46	6	49	Discard A3.3: It is a repetition of A2.1. Move the first sentence to the beginning of A2.1 [Government of Germany]
4886	SPM	6	46	6	49	Subsection A2.1, A2.5 and A3.3 provide similar information, please combine and shorten. In addition, please consider to remove some of the technical details and find a more accessible format for the quantitative information provided (e.g. relative change). See also our general comment on sections A1 and A3. [Government of Germany]
6000	SPM	6	46	6	49	In this sentence, it would be better to express the ocean heat content than the rate of ocean warming. The trend of ocean heat content change has already discussed in A2.1. Therefore, it is needed to organize two sentence. The description on ocean warming in A3.3 does not acturally focus on the subject of A3 (global sea level rise) and repeated (as mentioned in A2.1 with different numbers). To fit to A3, the contribution of thermal expansion to global sea level rise needs to be described in mm/yr rather than warming. [Government of Republic of Korea]
6052	SPM	6	46	6	49	Which ocean we are talking about here? or which area specifically?! this is a broad assumptions apparently! [Government of Saudi Arabia]
6494	SPM	6	46	6	49	Warming rates are presented for a different reference period, as compared with lines 24-28 on SPM-5. Be consistent. [Government of United States of America]
6496	SPM	6	46	6	49	This paragraph might be better placed adjacent to A2.1. [Government of United States of America]
6498	SPM	6	46	6	49	The ocean warming (A3.3) seems out of place and more fitting to A2, except for the relationship to the thermal expansion component of SLR. However, this is not explicitly stated here. Add that context to the point, which then links it to the following statement A3.4. [Government of United States of America]
7720	SPM	6	46	6	49	Since this paragraph deals with ocean warming, it should be better placed under section A.2 [Government of Spain]
7830	SPM	6	46	6	49	These rates would be more intuitive if they were converted back to temperatures. Also if the aim of the sentence is demonstrate doubling of the temperature increase then it is more logical to order the insights by time rather than by depth (i.e. for shallow water, 3.22 from 1969 to 1993 and 6.28 since 1993, then the equivalent for deeper water). See A3.4 and B2.2 for more intuitive examples of how they express their rates. [European Union]
4314	SPM	6	47	6	47	Units very inconsistent. Specially the yr-1, should be as superscript. [Government of Monaco]
802	SPM	6	47	6	48	Please consider using units which are understandable for policymakers. To avoid mentioning "zetajoules" we suggest to rephrase A3.3 as : "The rate of ocean warming has doubled between the period 1969-1993 and 1993-2017, both for 0-700m and 700-2000m depth." The details about numbers (and use of zetajoules) is not necessary here. Please discuss thermal expansion as well here, mentioning explicitly the contribution of thermal expansion to sea level rise (either a percentage or a mm/yr value). [Government of France]
2670	SPM	6	47	6	48	As per the earlier comment, suggest that the ZJ yr-1 units are translated into something more tangible, such as % equivalent temp rise per decade, or if that is impossible - something that puts it in a (any) context, and/or it could be helpful to express these in terms of contribution to global mean sea level rise (either by height or by percentage) [Government of United Kingdom (of Great Britain and Northern Ireland)]

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6500	SPM	6	47	6	48	Can these values be given in °C as well, as ZJ is not an easily understandable scaling system. [Government of United States of America]
6502	SPM	6	51	6	51	Insert "the rate of rise is" after "and". [Government of United States of America]
8544	SPM	6	51	6	51	Can this not be given as a stronger statement of fact? What is the source of the 1% uncertainty that leads to only "virtually certain"?. As a secondary issue, the sentence does not make grammatical sense. What is accelerating? You need to add something like "and the rate of increase is accelerating". [Government of Switzerland]
130	SPM	6	51	6	52	In order to add clarity the following wording is suggested: Observations show that global mean sea level is rising (virtually certain) with accelerating rate (high confidence). [Government of Austria]
3188	SPM	6	51	6	52	Again, this statement should use the past tense: global mean sea level has risen and the rate of sea level rise has accelerated – add over what period of time. Recommend saying that the rate of sea level rise was higher over yyyy-zzzz than it was over xxxx-yyyy, at some likelihood level. The meaning of 'accelerating' is ambiguous, and the likelihood attached to the assessment depends on the periods considered. [Government of Canada]
4316	SPM	6	51	6	52	Why there is no link between ocean temperature raise, thermal expansion and contribution to SLR? [Government of Monaco]
4888	SPM	6	51	6	52	Please state explicitly that sea level rise is due to global warming. [Government of Germany]
6054	SPM	6	51	6	52	How does the GMSL is calculated? [Government of Saudi Arabia]
8406	SPM	6	51	6	52	"accelerating" can be interpreted to mean a constant (quadratic) acceleration, which is unhelpful. Consider using "the rate is increasing" [Government of New Zealand]
4890	SPM	6	51	6	53	Move paragraph up, it should become A3.1 [Government of Germany]
7832	SPM	6	51	6	53	If the estimate of the sum of glacier and ice sheet contributions versus the effect of thermal expansion of ocean water is known, such figures should be given as this is a relatively new feature in the sources of sea level rise. [European Union]
6510	SPM	6	51	7	16	There is a bit of duplication between A3.4 and A3.6. Both note extreme sea level events associated with tropical and extra-tropical cyclones. Perhaps A3.6 relates directly to anthropogenic change while A3.4 is just change, but could perhaps benefit from some reorganization. [Government of United States of America]
1342	SPM	6	51	7	4	Section A3.4: Please provide also total numbers and not only trend [Government of Luxembourg]
6504	SPM	6	51	7	4	The sentence "Climate change has increased the height of extreme sea level events associated with a number of observed tropical- and extra-tropical cyclones (high confidence)" does not seem to fit here because the other sentences in A3.4 refer to GMSL. Consider moving this sentence to A3.6 instead because that section mentions extreme sea level events associated with cyclones. [Government of United States of America]
6506	SPM	6	51	7	4	Consider adding "As GMSL rises, extreme sea level events associated with cyclones that are rare today will increase in probability. [6.3]" [Government of United States of America]
6508	SPM	6	51	7	4	Ice sheet change is going to be the major factor ahead, and there is a very high sensitivity. Consider adding that 95+% refers to glacial/interglacial periods. [Government of United States of America]
4244	SPM	6	52	6	53	A3.4: That melting of land ice is the dominant source of sea level rise is a new finding compared to AR5. This finding therefore deserves highlighting in the A3 summary (shaded section). [Government of Norway]
7834	SPM	6	52	6	53	What measure of GMSL rise does the statement (on the new dominant source) apply to? Is ice melting the dominant source of the acceleration, or of the current increase (e.g., year-on-year) or of the cumulative increase to date? [European Union]
8218	SPM	6	52	6	53	This was already the case in AR5 [Government of Austria]
2724	SPM	7	1	7	2	This section tells us the GMSL rise for 1901-1990 is around 1.4mm a year. Would it therefore be accurate to say also include that total GMSL rise for 1901-1990 was around 0.12m? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3648	SPM	7	1	7	2	The -1 in yr-1 should be superscripted [Government of Brazil]
6512	SPM	7	1	7	2	There should be a comparison between similar record lengths. Ideally compare global rates from altimeter and/or tide gauge reconstruction over 26-year periods (e.g., from 1993-2018) Are rates now unique statistically? Likely or very likely unique? [Government of United States of America]
6514	SPM	7	1	7	2	It seems somewhat problematic to compare a recent 11-year period with a previous 90-year period as a means to illustrate potential acceleration of SLR. Could authors reference multiple periods of the same length in the past to demonstrate a more apples-apples comparison? Also, will "5th-95th percentile" be defined as a confidence bound somewhere? [Government of United States of America]
6516	SPM	7	1	7	2	"(3.1 to 4.1 mm yr-1, 5th-95th percentile)" -- This expression stands out from how other confidence levels are reported in the SPM. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6518	SPM	7	1	7	2	Replace the 2005-2015 GMSL trend with the 1993-2015 trend in the main report. Any 10-year trend will be greatly influenced by the timing of any strong ENSO events within that period. [Government of United States of America]
7444	SPM	7	1	7	2	We would suggest revising the GMSL rise period “2005 to 2015” to “2006 to 2015” to be consistent with the information in the main chapter. [Government of Japan]
3458	SPM	7	1	7	4	For clarity, please use the calibrated uncertainty language (likelihood statements), as appropriate. [Government of Sweden]
6056	SPM	7	1	7	4	What about the 15 years period from 1990-2005? Why there is no data during this period? [Government of Saudi Arabia]
7446	SPM	7	2	7	3	“The height of extreme sea level” will be better instead of “the height of extreme sea level events”. [Government of Japan]
8178	SPM	7	2	7	3	"Climate Change" is a generic statement to link with the increase in height of extreme sea-level events. It may be better to replace it with "global warming". [Government of India]
1468	SPM	7	2	7	4	Last phrase of A3.4 on extreme sea level events overlaps with A3.6, so contents could be merged into A3.6 [Government of Italy]
3190	SPM	7	2	7	4	Please double check the statement “Climate change has increased the height of extreme sea level events associated with a number of observed tropical- and extra-tropical cyclones (high confidence). {4.2.1., 4.2.2, 6.2.2, 6.3.1, 6.8.2, Figure SPM.1.}” Also, this statement is not supported by Figure SPM.1. [Government of Canada]
4048	SPM	7	2	7	4	A3.4: The sentence starting with "Climate change has increased the height of extreme se level events…" seems to be overlapping with the information in A3.6. Please consider merging these statements such that this finding only appears once. [Government of Norway]
6520	SPM	7	2	7	4	Consider deleting "Climate change has increased the height of extreme sea level events associated with a number of observed tropical- and extra-tropical cyclones (high confidence)." As this is redundant with A3.6 (lines 12-16). [Government of United States of America]
8480	SPM	7	2	7	4	Neither changes in extreme sea level nor number of tropical or extra tropical cyclones are included in Figure SPM.1 therefore delete the reference to this Figure. [Government of Canada]
590	SPM	7	3	7	3	Please consider reformulating "a number" or specifying its meaning [Government of France]
4318	SPM	7	3	7	3	Typo: remove '-' [Government of Monaco]
4538	SPM	7	3	7	4	It is not clear what is cause and impact. Are extreme sea level events consequence of tropical storms and are these storms the consequence of climate change? [Government of Belgium]
6522	SPM	7	3	7	4	Consider changing the phrase "a number" to "two", or striking the sentence altogether. Table 6.2.2 mentions two tropical cyclones studies for which the height of "extreme" sea level events had an anthropogenic component (Sandy and Haiyan). Also, Box 6.1 (case study 3) indicates that "Climate change increased the rainfall intensity associated with Harvey by at least 8% (8-19%; Risser and Wehner, 2017; van Oldenborgh et al., 2017) (high confidence)." Therefore, consider adding Box 6.1 in the reference of A3.6. [Government of United States of America]
8220	SPM	7	3	7	4	this is also mentioned in A3.6 What is the benefit of repetition? [Government of Austria]
592	SPM	7	6	7	10	The postglacial rebound (also called isostatic adjustment, isostatic rebound or glacio-isostasy) should me mentionned in this part indicating that global sea level is effectively rising but in some places this is not the case due to this phenomenon. [Government of France]
2720	SPM	7	6	7	10	Is it possible to include a figure showing how this variation in SLR will vary regionally? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3192	SPM	7	6	7	10	This statement is misleading and gives the impression that relative sea level has increased everywhere. However, this is not the case, there are locations where relative sea level has fallen (e.g., refer to tide gauge record in Churchill, MB). Glacial isostatic adjustment is an important factor in some regions and this has to be more clearly stated. [Government of Canada]
4068	SPM	7	6	7	10	A3.5: Consider adding information on where the SLR is higher or lower/which areas are more or less vulnerable. Furthermore: it is not selfevident what local antropogenic subsistance is in this context. [Government of Norway]
6002	SPM	7	6	7	10	Spatial difference in rate of global mean sea level rise was described without quantitative separion into different effects of thermal expansion, ice loss, and so on. [Government of Republic of Korea]
6526	SPM	7	6	7	10	This summary statement is too general and needs to be more explicit about the time scales of regional sea level variations. On short time scales (hours to weeks), regional sea levels can vary much more than ±30% around the mean because of precipitation (river discharge) and wind stress anomalies. On seasonal/interannual time scales, the anomalous storage of water in land reservoirs can change regional sea levels. Also, regional variations in heat and salt both contribute to density and therefore sea level (not just therml expansion). The reference to land ice contributions is ambiguous. Is the reference to changes in the geoid or changes in ocean mass, or both? [Government of United States of America]
8222	SPM	7	6	7	6	observations ….. [Government of Austria]

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6058	SPM	7	6	7	7	This will bring again the question of how does the GMSL is calculated? [Government of Saudi Arabia]
8408	SPM	7	6	7	7	Delete "will", since this sentence explains the previous one (observations) as well as the future changes. [Government of New Zealand]
594	SPM	7	6	7	8	What are the geographies mainly concerned ? [Government of France]
596	SPM	7	6	7	8	Regarding regional departures, it seems that changes in sea-ice or marine ice-sheet matter also. Therefore we suggest to replace "land ice" with "ice" [Government of France]
6524	SPM	7	6	7	8	Strike "will" and replace with "have generated" (to be in line with section focusing on observed changes). [Government of United States of America]
7836	SPM	7	6	7	8	Please, add the level of confidence for the first senctences of the paragraph A3.5. [European Union]
7838	SPM	7	6	7	8	"Sea level has not risen uniformly across the globe (…): It would be good to mention in the SPM which areas of the planet are the most/least affected. [European Union]
3460	SPM	7	7	7	7	Suggest omitting "will", as here the focus is on observed changes. [Government of Sweden]
6060	SPM	7	7	7	7	30% +/- is very high variance percentage which indicates uncertainty on sea level rising or the GMSL! [Government of Saudi Arabia]
8224	SPM	7	7	7	7	.. and projections should be distinguished more cleraly. Has there been already a non-uniform rise? Or is it only expected for the future? [Government of Austria]
8482	SPM	7	7	7	7	It is unclear whether or not the loss of land ice referred to here is meant to refer to the loss of ice age ice sheets (affecting vertical land motion and hence relative sea level change). [Government of Canada]
8546	SPM	7	7	7	7	You probably mean "…and ice loss contributions have generated regional departures……". This is a statement based on observations, not projections, so "will" in this context is incorrect. [Government of Switzerland]
3650	SPM	7	7	7	8	Replace "global mean sea level" with GMSL [Government of Brazil]
3194	SPM	7	8			What is 'anthropogenic subsidence?' This needs explanation in this summary even if fully defined in the main report. [Government of Canada]
3196	SPM	7	8		9	In several regions isostatic adjustment also makes an important contribution to local relative sea level change, which can be large compared to the other factors listed, and is important for adaptation planning. This contribution is not listed anywhere in the SPM at present, and should be included. [Government of Canada]
3700	SPM	7	8	7	10	Regional variations would be better understood than departures [Government of Ireland]
6062	SPM	7	8	7	10	Yet, I do not see any mention regarding the moon tidal effect!! [Government of Saudi Arabia]
6534	SPM	7	8	7	10	Its not clear why only anthropogenic subsidence is mentioned here. What about spatially variable subsidence from non-anthropogenic sources? Also, it is confusing to include waves and tidal changes on the same line as subsidence and reference all three of these factors to changes in relative sea level. Subsidence is a mean effect, while waves and tides are typically influencing high waters or extremes. Recommend separating these and to be clear on the impact of waves and tides. [Government of United States of America]
1056	SPM	7	8	7	8	Suggest replacing "anthropogenic subsidence" with "anthropogenic land subsidence". [Government of Australia]
6528	SPM	7	8	7	8	The phrase "local anthropogenic subsidence" is not clear at first callout. Move the explanation in B4 forward. [Government of United States of America]
6530	SPM	7	8	7	8	"Anthropogenic" is an odd modifier for this sentence. Presumably subsidence by any cause has the effect. If the intent is to suggest that subsidence is dominantly driven by human activity (withdrawal of subterranean fluids), then be explicit and cite accordingly; otherwise, either (i) drop the mention of subsidence, or (ii) modify it by 'both anthropogenic and natural subsidence'. In addition, clarification between global, regional (relative), and extreme sea levels is needed. [Government of United States of America]
804	SPM	7	8	7	9	Please rephrase as…. "Local anthropogenic activities can increase subsidence […] contributing to very significant changes […]" …. or give examples as in the glossary "due to loading, extraction of hydrocarbons and/or groundwater, drainage, mining activities" or like in chapter 4 4-82 : "(e.g., oil/gas/water extraction, mining activities)". For better readability, please avoid "anthropogenic subsidence" [Government of France]
6532	SPM	7	8	7	9	Include the effect of locally increasing tidal ranges as well as sea level rise on extreme water levels and tidal flooding due to navigational channel deepening and harbor improvements, increasing penetration of tides up rivers. [Government of United States of America]
6536	SPM	7	9	7	9	The justification for a reference to 6.2.2 in A3.5 is weak. Maybe the authors intend to reference regional sea level rise variations in the context of the 2013 Typhoon study, which mentions that background SLR had increased from negative PDO phase. It shouldn't be so difficult to find justification for a reference. Consider removing it. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8548	SPM	7	12	7	12	On line 2 above you speak of simply "climate change". Here you specify "anthropogenic climate change". Is this distinction intentional? Be sure to be consistent in your use of these terms throughout the SPM (and underlying chapters) because misuse of these terms can have severe consequences for the meaning of the statement. [Government of Switzerland]
6538	SPM	7	12	7	13	This is overly vague. How have extreme sea levels changed in 'some' tropical and extratropical cyclones? [Government of United States of America]
8674	SPM	7	12	7	14	The sentence "Anthropogenic climate change … Cascading impacts (high confidence)" is too complicated/hard to understand. Please simplify. [Government of Netherlands]
2722	SPM	7	12	7	15	Is it possible to quantify the frequency or intensity to which extreme sea level events can be attributed to anthropogenic climate change (e.g. x% increase)? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3198	SPM	7	12	7	15	Sentence is awkward and unclear. Suggest ending the first sentence after the word “cyclones” – this first part of the sentence conveys a clear message. A separate second sentence should then convey the message that coincident or sequential extreme events have led to a cascade of impacts in affected areas. [Government of Canada]
7840	SPM	7	12	7	15	Suggest including examples for projected increases of extreme weather events, where estimates available. [European Union]
8586	SPM	7	12	7	15	A3.6 it is not clear to what extet/actual increase of precipitation, winds, sea level (etc as presented in this text) that caused from Anthropogenic climate change apart from natural climate change. [Government of Kiribati]
4646	SPM	7	12	7	16	Suggested correction: 'Observed global climate change has increased precipitation' [Government of Russian Federation]
6540	SPM	7	12	7	16	The A3.6 summary statement says ""extreme wave heights across the globe have increased by around 5% …"" but the Chapter 6 text says ""Satellite observations from 1985 to 2018, showed small increases in significant wave height and larger increases (5%) in extreme wave heights (90th percentiles), especially in the Southern Ocean (Young and Ribal, 2019)"". The Young and Ribal paper states ""The regional distribution of trends for the 90th percentile wind speed shows statistically significant increases in most areas. In contrast, increases in 90th percentile waves are confined to the Southern and North Atlantic oceans."" Thus, the Chapter 6 text misinterprets the paper's conclusions when it says ""especially"" because the increase in extreme waves (90th percentile) is found ONLY in the Southern and North Atlantic Oceans. The A3.6 summary further exaggerates the finding by spuriously extending the finding of higher probability of extreme wave heights to the ""globe"". [Government of United States of America]
6542	SPM	7	12	7	17	Add 6.2.2 to list of section references (regarding extreme sea level events associated with cyclones). [Government of United States of America]
3200	SPM	7	13	7	13	Request that you please double check the statement and confidence level “… sea level events associated with some tropical- and extra-tropical cyclones … (high confidence)”. [Government of Canada]
3202	SPM	7	14		15	Recommend noting that extreme wave heights have increased primarily due to an increase in mean sea level. [Government of Canada]
6544	SPM	7	14	7	14	KEY ISSUE [JARGON]: "cascading impacts" is jargon. A brief explanation is warranted, preferably at first usage (i.e., A3.6). It's defined in Section 6.1: "Cascading impacts from extreme weather/climate events occur when an extreme hazard generates a sequence of secondary events in natural and human systems that result in physical, natural, social or economic disruption, whereby the resulting impact is significantly larger than the initial impact. Cascading impacts are complex and multi-dimensional, and are associated more with the magnitude of vulnerability than with that of the hazard." At minimum, add Figure 1.1, Figure 6.1, and 1.3 and 6.1.1 to the section callout. [Government of United States of America]
2702	SPM	7	15	7	15	Extreme wave heights - have these increased by 5% higher heights? Is it possible to add by how many mm or cm? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6548	SPM	7	18	11	2	There is a glaring oversight of a lack of discussion on the loss of permafrost habitat on high-latitude and high-elevation ecosystems. A point should be added to include them and the impacts of permafrost loss. [Government of United States of America]
6550	SPM	7	18	11	2	There is some mention of phenological changes in this section. Is there any documentation to be included here of mismatches in timing that have developed that result in reproductive, migratory, recriutment, or feeding failures? [Government of United States of America]
4892	SPM	7	18	7	18	Suggested rewording to Observed Impacts on Ecosystems and Species [Government of Germany]
6546	SPM	7	18	7	20	It seems that methane hydrates are excluded from the oceans component of SROCC (vs. geologic hydrates). Wouldn't increasing temperatures impact the hydrate formation and ebulation/release? [Government of United States of America]
4122	SPM	7	18	9	20	In general, the text describing ecosystem impacts under A4 is more qualitative and less quantitative than text under A1-A3 and A5. Is it possible to make the text more "to-the-point"/add more concrete examples/numbers where this is available? Since we are here talking about observed changes, it should be possible to follow up at least under some of the statements? [Government of Norway]
4124	SPM	7	18	9	20	Would it be possible to give a synthesis of what the most vulnerable ecosystems/habitats/species, are and where they are? [Government of Norway]

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3652	SPM	7	20	7	21	I suggest replacing "California Current and Humboldt Current" by "California Current System and Peru-Chile Current System" [Government of Brazil]
4130	SPM	7	20	7	23	Please consider simplifying this finding and make it more understandable to policy makers. We feel that the main message is that cryosphere changes have impacted the ecosystems incluing in fresh water, in high mountain and polar regions, and affected the important ecosystem services they provide and have impacts on both culture, economy and landscape. [Government of Norway]
4134	SPM	7	20	7	23	Unprecedented burnt areas and frequency of fires are dramatic findings that should be highlighted in the A4 shaded text. However, it is somewhat unclear to us where the area is burned and the frequency of fires unprecedented. Is it in the Arctic/sub-Arctic? In or close to high mountain regions? Both? Please consider elaborating on this. [Government of Norway]
4894	SPM	7	20	7	23	A4 would be easier to read and understand if the various information of this quite long sentence were put in three separate short sentences, e.g. "Cryosphere ... and polar regions. These processes affect abundance ... and animal species. Also the appearance of landscapes ... and ecosystem functioning are modified". [Government of Germany]
6552	SPM	7	20	7	23	The A4 summary box could be strengthened by adding some quantitative details and perhaps providing some concrete examples on types of changes occurring in the most impacted ecosystems. The current summary statement does not leave a reader with anything in particular to remember about the scope or magnitude of ecosystem changes due to cryosphere changes. [Government of United States of America]
598	SPM	7	20	7	44	Please add a mention to areas downstream high mountain regions whose ecosystems also depend on cryospheric changes (for example fluvial ecosystems) [Government of France]
6554	SPM	7	20	7	44	Section A4 in general glosses over a lot of detail and omits many concrete examples of how warming and changes in the cryosphere are impacting ecosystems regionally and globally. The three summary statements are extremely vague, and are not easily tied to major or minor consequences for ecosystems and how those impacts may affect societies and industry. Add some numbers so that the scales of change can be appreciated, and the magnitude of impacts on ecosystems and society can be understood. [Government of United States of America]
6556	SPM	7	20	7	44	The A4 sections seem thin. Other sections had more specific examples and much more precise quantitative information (in fact A4.1-3 didn't have a single numerical metric). A4 is by far the shortest section, so maybe there was an editorial constraint that reflected the presumed importance of ecosystem responses. [Government of United States of America]
7842	SPM	7	20	8	31	Sections A4 and A5 are lacking in quantification or other means of communicating the extent of the problem to non-experts. Is it possible to provide statistics, or at least illustrative, relatable examples of the phenomena mentioned such as: invasive species abundance, shifts in range and distribution, alterations of ecosystem functioning (terrestrial and/or marine). [European Union]
4132	SPM	7	20	9	44	We are missing information on impacts on wetlands. Would it be possible to add information on rain-on-snow? [Government of Norway]
8550	SPM	7	21	7	21	Suggest changing wording to ",... affecting both positively and negatively the abundance and distribution of....." Currently you don't specify the direction of this effect (positive or negative) and this is misleading, as 99% of readers would assume this headline statement is only about negative effects. However, lines 25 - 30 make it clear these effects have also been positive. It is the headline statements that will be most heavily quoted, so clarity is important. [Government of Switzerland]
6558	SPM	7	21	7	22	This statement should be amended to include lower elevation areas that are affected by the change in hydrologic regime due to changing snowpack and precipitation type. Authors are encouraged to treat downstream or remote implications of the observed changes. [Government of United States of America]
2726	SPM	7	22	2	22	It is not clear what 'disturbance regime' means here, please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6560	SPM	7	22	7	22	Define "disturbance regimes". [Government of United States of America]
4540	SPM	7	25	7	25	CH3 page 73 refers specifically to the expansion of non-native species, in some cases becoming invasive.Invasive species are not necessarily exotic species, as native species can also develop invasive behaviour! Therefore we suggest to formulate as 'Some species, including exotic [or 'non-native', or 'alien' as is used in underlying report] and invasive species, have increased abundance...." [Government of Belgium]
6562	SPM	7	25	7	25	"...in abundance..." Insert "in". [Government of United States of America]
8294	SPM	7	25	7	25	Insert "in" before "abundance" [Government of New Zealand]
1394	SPM	7	25	7	27	Is hard to understand how the last part of the sentence "and humans transported them" relates to the rest of the sentence. Is it correct for all cases in the first part of the sentence, that humans trasnported them? [Government of Denmark]

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4158	SPM	7	25	7	27	A4.1 first sentence: As this sentence is formulated at the moment it can be interpreted as no species having shifted range or established in new areas on their own, but that they all were helped by human transport. If this is not correct please consider changing the sentence accordingly (suggested change in bold): "Some epsecies, inlcuding invasice species, have increased abundance, shifted their range and established in new areas WITH RECEEDING GLACIERS, LONGER SNOW-FREE SEASONS AND/OR HUMAN TRANSPORT." [Government of Norway]
6564	SPM	7	25	7	27	The wording of this sentence implies that human transport was involved in all cases. Should be reworded to clarify that human transport was sometimes but not always a factor. [Government of United States of America]
8484	SPM	7	25	7	27	Replace "humans transported them" with "human introduction of non-native species" consistent with Ch. 3 Box 3.4 terminology. [Government of Canada]
3204	SPM	7	25	7	32	Para A4.1 requires some indication of the time periods over which these changes in species abundance and range have been observed. [Government of Canada]
3206	SPM	7	25	7	32	“some species, including INVASIVE SPECIES, have … shifted their range and established in new areas”: How is an invasive species distinguished from a species that has shifted its range? A more careful use of terminology is suggested here. [Government of Canada]
6566	SPM	7	25	7	32	Section A4.1 statement could be substantially strengthened by adding some quantitative detail and specific examples of seasonal change. [Government of United States of America]
6568	SPM	7	25	7	32	Literature suggests that the snow-free season has changed most dramatically during the spring. Those changes are well-documented with some solid numbers (days/decade) indicating that spring has been arriving earlier globally and regionally. Tied to these numbers is a host of other research that links these changes to the timing and loss of snow cover (globally and regionally) and green-up, along with a host of linked and documented changes to bird/animal migration. Suggest adding some statistics summarizing on average how many days/decade spring is arriving earlier (since 1950), and tying that to some specific examples of species migration and/or abundance changes. This would help to strengthen the very general statement that is already in place. [Government of United States of America]
7844	SPM	7	25	7	32	This observation does not describe impacts on ecosystems, contrary to what A.4 is supposed to inform about. The weighting of the information is not adequate; increasing the risk of extinction is a primary impact, whilst the enlargement of areas or activities of species may have or have not an impact of the extinction risk. This sentence is not a neutral description but weighting above its importance policy-suggestive possible neutral or positive language. We suggest the sentence to be changed into: " Some cold-adapted or snow-dependent species are declining in abundance, increasing their risk of extinction, notably on mountain summits and in polar regions (high confidence). Some species, including invasive species potentially disturbing cryosphere ecosystems, have increased abundance, shifted their range, and established in new areas as glaciers receded and the snow-free season lengthened, and humans transported them (high confidence). Together with warming these changes have increased local species richness in high mountains, as lower elevation species migrate upslope (very high confidence). In polar and mountain regions, many species have extended seasonal activities or have otherwise changed their behaviour, especially in late winter and spring (high confidence) of which the impacts for ecosystem functioning are not fully clear yet. {2.3.3, Box 3.4} [European Union]
4160	SPM	7	25	7	44	Is it possible to add material on changes in freshwater budgets. [Government of Norway]
2712	SPM	7	25	8	31	A4 and A5 includes many statements that say impacts occurring, without what saying what these impacts are. For example, A4.2 ('changes to…hydrology, wildfire and abrupt thaw are occurring'), A5 ('…have led to impacts on fisheries.'), A5.2 ('The cascading effects…impact fisheries'), A5.4 ('Ocean acidification… altered primary productivity… with direct impacts'). It would be helpful to add whether the impacts are positive or negative, and preferably state any trends, or give specific examples of the impacts. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2704	SPM	7	26	7	26	Suggested addition: 'established themselves in new areas as glaciers have receded and the snow-free season has lengthened, and humans have transported..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6570	SPM	7	26	7	26	Replace first instance of "and" with "and/or" (some species have experienced a combination of these). [Government of United States of America]
3462	SPM	7	26	7	27	If the "humans transported" refers to transport to areas made free from snow and ice, please clarify. If the statement is about more general human transport of species to new areas, it might be to general to be needed here. [Government of Sweden]
6572	SPM	7	26	7	27	Confusing language. Reword the "and humans transported them" clause. [Government of United States of America]
6574	SPM	7	27	7	27	Add comma after "warming". [Government of United States of America]
600	SPM	7	27	7	28	Please rephrase this sentence for better consistency with B4.1. As it is now in A4.1 ("richness"), it sounds as a positive impact. Please consider using the same wording as in B4.1. [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3550	SPM	7	27	7	28	The "Together with warming these changes have increased local species richness in high mountains," may sound overly positives, given rgar changes in species richness may be negative from the ecosystem integrity and functioning point of view. The statement could be modified to something like "Together with warming these changes have changed the species composition in high mountains,...". [Government of Sweden]
4172	SPM	7	27	7	28	If there are any observations of local extinctions or reductions in abundance of higher elevation species associated with lower elevation species moving in, please consider spesifically mentioning this. This sentence begs the question about what happens to higher elevation species. [Government of Norway]
8248	SPM	7	27	7	28	This statement should be qualified. In New Zealand context - shifting ranges of invasive predators can reduce species richness at higher elevations [A4.1] [Government of New Zealand]
7846	SPM	7	27	7	32	Here, we say that local species richness have increased due to upwards migration, but then some cold-dapted or snow-dependent species are declining. Could this paragraph be more precise? [European Union]
4542	SPM	7	28	7	28	..."have increased local species richness" in high mountains: this leaves room for interpretation. We suggest to formulate as 'increased species richness locally'. [Government of Belgium]
6576	SPM	7	28	7	29	It would help if the paragraph indicated that this is referring to both plant and animal species. [Government of United States of America]
1344	SPM	7	28	7	32	We consider it would be more logical to switch the order of the sentences as the later sentence related to mountainous areas related more to the previous sentence, than the one related to polar regions. [Government of Luxembourg]
1470	SPM	7	29	7	29	"many species have extended the seasonal activities", "altered" might better cover all changes in phenology mentioned in 2.3.3 and Box 3.4, equally important as extension. [Government of Italy]
2706	SPM	7	31	7	31	declining in abundance': is it possible to add a rate for this? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6578	SPM	7	31	7	32	The report mentions that "some cold-adapted or snow-dependent species are declining in abundance, increasing their risk of extinction..." Are there any specific statistics that could lend further support to this point by conveying the magnitude of this species decline? [Government of United States of America]
6580	SPM	7	32	7	38	There should be a clearer connection between these two sentences. There is no mention of fires in the first sentence but then a detailed statistic is included. This could be written to be a more cohesive summary. [Government of United States of America]
602	SPM	7	34	7	34	"Climate-related changes": does it include climate variability or it is solely anthropogenic climate change ? [Government of France]
6582	SPM	7	34	7	34	Exactly which "climate-related" variables are at play here? Does "climate-related" also mean long-term? [Government of United States of America]
6590	SPM	7	34	7	34	KEY ISSUE [STRUCTURE]: The statement that recent fire frequency and area burned are "unprecedented" over the past 10,000 years is wholly misleading and inaccurate. Both the descriptor and the time frame come from an assessment of Arctic/boreal processes; though, as portrayed in the SPM, they appear to refer to both polar and mountains (if not global trends) as a whole. Even as applied to the Arctic alone this statement is not in line with supporting evidence, as this originates from two studies of limited geographic scope. Suggest that this statement be qualified in far less dramatic terms. Likewise authors are encouraged to insert more specific detail on the regions/sectors to which this message applies, and to consider adding quantitative information (e.g., percentiles for observed area burned vs. relevant periods of interest) that would allow the reader to better assess recent fire activity in a longer term context. [Government of United States of America]
3208	SPM	7	34	7	35	It is unclear what “abrupt thaw” is referring to in this sentence in reference to arctic and mountain landscapes. Is this meant to refer to abrupt spring thaw affecting snow, ice and permafrost thaw? It would be more correct here to say "changes to permafrost conditions" or "permafrost thawing" rather than "abrupt thaw". Any thawing of permafrost (doesn't need to be abrupt) can result in the various impacts mentioned - also agrees better with text in sections mentioned.. It is also not clear whether you are trying to make the point here that wildfire may lead to permafrost thaw, given you specifically mention the frequency of fires in the second sentence. It is suggested that the paragraph be rewritten to be clearer. Also changes to snow, glaciers would also be important so why haven't these been specifically mentioned? [Government of Canada]
2714	SPM	7	34	7	37	Are the impacts on vegetation and wildlife largely negative or positive, or both? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8486	SPM	7	34	7	37	Time periods need to be reported for the observed changes in this paragraph. This is expecially true to support the statement about unprecedented changes in wildfires. [Government of Canada]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8588	SPM	7	34	7	37	A4.1 It would be good to present also the abundance and movement of invasive speices in pacific regions especially in coral atoll islands without mountains as it does not captured in this text. this is also very important to consider given the different in climate seasons i.e in Kiribati only dry and wet seasson exisit, hence the respond or behavioral change of invasive species against such sessions also important to capture to reflect the context from coral atoll islands [Government of Kiribati]
3558	SPM	7	34	7	38	It might be useful to write this paragraph in the same style as the other ones, saying what the changes are. The present introduction by "Climate-related" is probably not needed, and also risks confusion as to whether the changes are related to climate, climate variability, climate change or anthropogenic climate change… [Government of Sweden]
6584	SPM	7	34	7	38	Section A4.2 could be strengthened by adding some details on how mountain hydrology is changing. What parts of the world are seeing increased flow or decreased flow, and does this fall in line with expectations from climate models? [Government of United States of America]
6586	SPM	7	34	7	38	What about changes in timing of flows from mountain hydrology in snow-dominated and snow transitional regions? There are some solid numbers on regional and global changes in timing and amount of flows in snow-dominated mountain catchments that could be featured here. The same types of numbers could be provided for the summary on wildfire as well. [Government of United States of America]
6588	SPM	7	34	7	38	The statement that wildfire frequency and area burned is unprecedented in the last 10,000 years is potentially problematic. This statement does not capture regional variations adequately (i.e., it may be true in some regions, but not others). [Government of United States of America]
8552	SPM	7	34	7	38	This is a very vague statement, giving no indication if impacts have been positive or negative. Is the area burned and frequency of fires unprecedentedly high or low? Compare, for example, to the next paragraph (A4.3) where you are much more specific and clearer. [Government of Switzerland]
3210	SPM	7	36		37	This statement is stronger than the underlying assessment. The high confidence SPM statement that area burned and frequency of fires (including extreme fires') are unprecedented over the last 10000 years (with no region specified, so implicitly global) is based on a single study of single region in Alaska (Kelly et al., 2013). (Globally area burned is decreasing - see e.g. Arora et al., 2018; s41467-018-03838-0). Moreover, since that study was based on charcoal records in lakes, the study only assessed a single unitless measure of fire activity, and not area burned, frequency and extreme fires as indicated in the SPM statement. Revise to be consistent with underlying assessment. [Government of Canada]
604	SPM	7	36	7	37	is it possible to tell which part is natural and which part is anthropogenic? [Government of France]
7848	SPM	7	37			The types of fires concerned and their regional distribution should be mentioned. Is it about forest fires? Or peat? Is the evidence specific to (or representative of) the Arctic and high mountains? [European Union]
6592	SPM	7	37	7	37	"unprecedented" presumably refers to increasing fire area/frequency, but this idea might be strengthened by more specific language. How big an increase is this? [Government of United States of America]
6594	SPM	7	40	7	41	"often increased"? Perhaps something like "mean plant productivity has increased" instead. [Government of United States of America]
6596	SPM	7	40	7	42	KEY ISSUE [STRUCTURE]: Should high mountain and polar regions be discussed in same sentence? Responses are quite different among regions and biomes. [Government of United States of America]
6598	SPM	7	40	7	44	Consider adding numbers to the amount of area that has been shown to be greening versus browning in global tundra areas. [Government of United States of America]
6600	SPM	7	40	7	44	What about other impacts to boreal forests? There is no mention of permafrost melt destabilizing stands of boreal forest or large-scale bark beetle outbreaks? Also suggest elaborating a little on major ecosystem services that have changed for the positive and negative -- specifically, those services for which there is strong confidence in the recent directions of change. [Government of United States of America]
6602	SPM	7	40	7	44	How are these two sentences connected? This could be written to be a more cohesive summary. [Government of United States of America]
6604	SPM	7	40	7	44	Explain what "greening" and "browning" mean - changes in biomass, or productivity? [Government of United States of America]
7850	SPM	7	40	7	44	The meaning of "greening" and "browning", as well as their relationship to changes in productivity, should be explained. Also, what measure of productivity is considered? NPP? GPP? NEP? Does the increase in productivity outpace the increase in respiration? How is greening measured/quantified? [European Union]
8590	SPM	7	40	7	44	A4.3 Again this text focus only on polar and mountain regions for plant productivity, why not this report present plant productivity status from small island counties as well especially with those calcacerious soil in nature including Kiribati. Currently plants productivity in Kiribati is very low with poor soil quality and already theatened by prolong droughts. this is also very important to consider in the report to present different plant productivity status in each different region/soil richness countries [Government of Kiribati]

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606	SPM	7	42	7	44	Please consider giving some examples (enabling the provision of new habitat for endemic plant species / degrading the provision of services as fodder or wood production…). [Government of France]
4212	SPM	7	42	7	44	A4.3: this statement is overarching, and could come first of the three A4 statements [Government of Norway]
7852	SPM	7	42	7	44	Add "with regulating services decreasing" to the end of the sentence, to read: "… have affected ecosystem services both positively and negatively, with regulating services decreasing." [European Union]
7854	SPM	7	42	7	44	Examples of the positive and negative effect on ecosystem services could be included so to better illustrate what is meant by such effects, as such adjectives are not univoquely interpreted by policy makers. Also, it could be clarified whether positive fully balance out the negative ones. The statement as it stands gives this impression. [European Union]
1058	SPM	7	43			Suggest defining "ecosystem services". [Government of Australia]
7534	SPM	7	43	7	44	Examples of ecosystem services affected positively and negatively would clarify sentence. [Government of Finland]
608	SPM	7	46	7	46	Please consider adding "and temporal" after "geographical" [Government of France]
1060	SPM	7	46	7	46	Suggest rephrasing to read "Geographical shifts in marine species' from plankton, fish to mammals and seabirds have occurred …". [Government of Australia]
6606	SPM	7	46	7	46	replace "from" with "such as", or change "and" to "to". [Government of United States of America]
6608	SPM	7	46	7	46	Species should not be possessive; insert commas after "species" and "seabirds". [Government of United States of America]
6610	SPM	7	46	7	46	Change "occur" to "have occurred". [Government of United States of America]
8296	SPM	7	46	7	46	Replace the comma after "plankton" with "and" such that it reads: "….from plankton and fish to mammals and seabirds…." [Government of New Zealand]
8626	SPM	7	46	7	46	A word appears to be missing after " species' ", perhaps range or distribution? [Government of Netherlands]
3212	SPM	7	46	7	47	please review and revise wording -- the word 'range' appears out of place if it is being used as a verb. [Government of Canada]
2718	SPM	7	46	7	49	Suggest this sentence could be restructured for clarity, i.e. ''Ocean warming has caused many marine species' (including plankton, fish, mammals and sea birds) to shift their geographical ranges by hundreds of kilometers, with changes occurring more frequently since the 1950s. This has consequences for species interactions that can affect abundance and cause cascading impacts on ecosystem structure." [Government of United Kingdom (of Great Britain and Northern Ireland)]
4896	SPM	7	46	7	49	The first sentence in A5 presents a lot of information which may be separated in three sentences, e.g. "Geographical shifts … occur due to ocean warming since the 1950s (high confidence). The area shift may be up to hundreds of kilometres and more. Those range shifts will affect species' abundance and cause cascading impacts on [pls add:] even the whole ecosystem structure (medium confidence)." [Government of Germany]
6612	SPM	7	46	7	49	This first sentence is gramatically incorrect (run on) and needs to be edited. [Government of United States of America]
6614	SPM	7	46	7	49	The first sentence is confusing and should be parsed into multiple sentences to reduce the number of concepts addressed. Additionally, the statement, as written, does not fully capture the issues presented in the cited chapters which extend beyond warming and regional species shifts. In fact, the chapters speak to both regional shifts (e.g., a general movement poleward and/or deeper) and perhaps equally or more importantly changes in phenology (e.g., timing of biological events are shifting earlier in the year). A proposed rewording of the first sentence follows: "Since the 1950s, species' ranges have shifted poleward and deeper, consistent with expectations based on current physiological understanding of organismal sensitivity to temperature and oxygen (high confidence). Ocean acidification will influence species distributions as it progresses (medium confidence). Species phenology has also been altered, changing the timing of biological events, such as reproduction." [Government of United States of America]
8628	SPM	7	46	7	49	Have the shifts been hundreds of kilometers and more for all species in the mentioned groups (plankton, fish, mammals, birds)? That seems doubtful (though potentially true), but is what a strict reading of the sentence implies. [Government of Netherlands]
938	SPM	7	46	7	50	Impacts noted here on ecosystems needs to be linked to loss of livelihoods and food security issues. [Government of Jamaica]
1472	SPM	7	46	7	50	This high level summary A5 of observed impacts on ecosystems could mention more than the space distribution shifts due to warming, e.g. some of the multistressor aspects related to acidification and oxygen loss discussed in 5.2.3. As it is, A5.4 appears out of place under A5. [Government of Italy]
3214	SPM	7	46	7	50	This headline sentence needs work. Best to split long sentence into two, with one message per sentence. First sentence could be "geographic shifts in the ranges of many marine species, extending hundreds of kilometers, have occurred since the 1950s due to ocean warming. Second sentence would be about the consequence of range shifts for species interactions. [Government of Canada]

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6064	SPM	7	46	7	50	There might be another reason apart from ocean warming, which is the transfer of invasive species. Scientists first recognized the signs of an alien species introduction after a mass occurrence of the Asian phytoplankton algae Odontella (Biddulphia sinensis) in the North Sea in 1903. But it was not until the 1970s that the scientific community began reviewing the problem in detail. In the late 1980s, Canada and Australia were among countries experiencing particular problems with invasive species, and they brought their concerns to the attention of IMO's Marine Environment Protection Committee (MEPC). [Government of Saudi Arabia]
8512	SPM	7	46	7	50	A5: Vital importance for Kiribati as added to the limited resources available for the population, an alteration of species distribution could have really severe negative effects in terms of resources. [Government of Kiribati]
4232	SPM	7	46	8	31	Would it be possible to add a key finding on ice dependent species? For instance a simplified text drawned from SROCC box 3.4: Ongoing climate change induced reductions in suitable habitat for Arctic sea ice-affiliated endemic marine mammals is an escalating threat (Section 3.2.3.1) (high confidence). [Government of Norway]
1062	SPM	7	47	7	47	Suggest clarifying "hundreds of kilometers and more". Is it up to a thousand kilometers? Line 15 on Page 8 implies it couldn't be more than a few hundred kilometers since the 1950's. [Government of Australia]
2708	SPM	7	47	7	47	Suggested addition: 'ranges have shifted hundreds of..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6616	SPM	7	47	7	47	Change "and more" to "or more". [Government of United States of America]
2710	SPM	7	48	7	48	species interactions' - does this mean he dynamic between predators and prey? It would be useful to define in a more tangible way if possible. [Government of United Kingdom (of Great Britain and Northern Ireland)]
610	SPM	7	49	7	50	"maximum potential catch" is not easy to interpret. Prefer the definition given in Chapter 5 section 5.4.1: "potential of the fish stocks to provide long-term fish catches". Please add this definition of maximum catch potential in the glossary, because the expression is frequent in the SPM. [Government of France]
806	SPM	7	49	7	50	Please introduce in the headline a reference to acidification and desoxygenation as they are discussed in A5.4. [Government of France]
4320	SPM	7	49	7	50	Should findings that are only rated "medium confidence" be highlighted in these wrap-up boxes. [Government of Monaco]
4544	SPM	7	49	7	50	This section is about impacts on ecosystems, therefore it seems more appropriate to refer to fish populations, and health of fish populations (including the fish stocks of commercially exploited fish populations), food webs, etc. The concepts of maximum catch potentials, fish stocks etc. is usually reserved to an economic and hence anthropogenic context. In the next sections, including the one dealing with the 'impact on people', the fisheries are dealt with/referred to already. [Government of Belgium]
6618	SPM	7	49	7	50	Need to be more explicit with respect to what the effects have been on fisheries. Species range shifts and/or changes in catch? [Government of United States of America]
1396	SPM	7	50	7	50	Impacts on fisheries - is it possible to be more specific, size of impact, increase/decrease. The word impact in itself does not convey much information. [Government of Denmark]
2716	SPM	7	50	7	50	Are the impacts of the changes in species distribution, composition and maximum catch potential on fisheries negative? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3216	SPM	8	0			Figure SPM.2. In the legend, the confidence assessment is indicated as referring to 'attribution to changing climate/cryosphere'. But the figure includes physical changes in the ocean. How can physical changes in the ocean, such as temperature, be attributed 'to changing climate'? I think in the case of the physical variables, the attribution is to anthropogenic forcing, is that correct? Recommend clarification to legend. [Government of Canada]
3218	SPM	8	0			Figure SPM.2 indicates that Arctic ocean warming has been attributed with medium confidence. This is not sufficiently supported by the underlying assessment in 3.2.1.2.1 please review. [Government of Canada]
4042	SPM	8	1	8	12	A5.1 and A5.2: are these findings specific to the polar regions, or are they also observed elsewhere on the globe? Please consider elaborating on this. [Government of Norway]
3220	SPM	8	1	8	2	This is one of many instances where calibrated confidence language is inappropriately applied to what is essentially a factual statement. These need to be rectified as otherwise the confidence qualifiers lose their meaning and impact in instances where they are truly required (such as the second sentence in this paragraph). [Government of Canada]
6620	SPM	8	1	8	2	The first sentence in A5.1 is not meaningful. What are the variable impacts? Are they consistent amongst similar regions? The first sentence is poorly supported by adopting only two examples, both from polar environments. If marine primary producers have been impacted worldwide, then a more diverse set of environments should really be illustrated and/or include some specific quantifiable metrics of the worldwide change (e.g., "global net annual primary production has…"). [Government of United States of America]

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2748	SPM	8	1	8	31	It would be helpful if this section would also include a summary of policy relevant text on the impact of multiple stressors on ocean ecosystems (section 5.2.3, pg 5-47), "overall, direct in-situ observations and laboratory experiments show that there are significant responses to the multiple stressors of warming, ocean acidification and low oxygen on phytoplankton, zooplankton and fishes and that these responses can be additive or synergistic (high confidence)." [Government of United Kingdom (of Great Britain and Northern Ireland)]
4898	SPM	8	1	8	4	What is the consequence of earlier phytoplankton blooms in the Arctic? Please clarify. [Government of Germany]
2744	SPM	8	1	8	6	A5.1 could use some minor rephrasing in order to remove the possibility of being read as if phytoplankton blooms are related to retreating glaciers. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3222	SPM	8	1	8	6	The confidence in the statements that phytoplankton blooms have increased in intensity and duration in the Arctic is overstated. The report says that there's 'high confidence' that the timing, distribution, and production of primary producers in the Arctic has changed, without specifying similar confidence in the direction of those changes. The claim of increased primary production is based primarily on remote sensing studies, which can only observe surface open-water primary production (i.e., not production in or under sea ice or in deep chlorophyll maxima), and thus, at least part of the apparent increase is due simply to the increase in the area being observed. Only one, regionally limited, reference is given for corroboration by in-situ observations, and the modelling studies acknowledged that their analyses were limited by scarcity of nutrient observations and that increasing nutrient limitation might actually be reducing total primary production. [Government of Canada]
3556	SPM	8	1	8	6	For the Antarctic, the "regional" probably implies sub-regional (if the Antarctic is seen as a "region"). The two uses of "regional" in this paragraph makes this, however, a bit unclear. Another wording might be useful here. [Government of Sweden]
6622	SPM	8	1	8	6	Are there any references of changes in timing for regions other than the Arctic? [Government of United States of America]
7856	SPM	8	1	8	6	Point A5.1 is very vague that basically says that there are lots of things happening, but then gives a very specific example (Phytoplankton phenology in one region). This could all simply be deleted, as it adds little. [European Union]
1064	SPM	8	2	8	2	Suggest replacing "variable impact" with "varying impacts". [Government of Australia]
2728	SPM	8	2	8	2	Not sure the average policymaker know what is meant by 'primary producers', suggest this is spelled out - e.g . species forming the foundation of marine food chains. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8298	SPM	8	2	8	2	Change "producers" to "production" [Government of New Zealand]
612	SPM	8	2	8	4	The high confidence given to the Arctic phytoplaknton blooms statement is overconfident. Satellites do not see below ice, and production below ice is not well quantified. Lowry et al (2014) model study confirm that under-ice blooms have been there for a while, which questions that the increase in Arctic production seen from satellites might be an artefact of the fact they don't see below the ice. Kahru et al (Biology letters, 2016), see earlier blooms, but also earlier bloom termination. [Government of France]
614	SPM	8	2	8	4	Please consider adding a quantitative or qualitative clarification to "earlier" [Government of France]
2742	SPM	8	2	8	6	Are these changes in phytoplankton blooms directly linked to sea ice decline? If so it may be best to clarify this. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6624	SPM	8	4	8	5	"locally-rapid" perhaps better as "rapid, local"? [Government of United States of America]
3562	SPM	8	7	9	20	A projected sea level rise (IPCC, 2013), due to the climate change, poses threat to the coastal ecosystems, especially the mangroves , bays etc. around the island. Rising water levels in mangroves and intrusion of saline water to inland water bodies can harm the habitats of plants and animals well adapted to the present ecological conditions (Reference Kottawa-Arachchi, J.D. and Wijeratne, M.A., 2017. Climate change impacts on biodiversity and ecosystems in Sri Lanka: A Review. Nature Conservation Research, 2(3), pp.2-22..) [Government of Sri Lanka]
7860	SPM	8	8			Should also have a "ocean" icon at the beginning of A5.2. [European Union]
4904	SPM	8	8	8	12	Changes on phenology mentioned here focus only on the Arctic but in the report are more general (in spite of being biased towards the North East Atlantic); see 2nd paragraph, page 5-47. This part can read in general "phenology of marine ectotherms in the epipelagic systems are related to ocean warming (high confidence) and the timing of biological events has shifted earlier (high confidence)". [Government of Germany]
7858	SPM	8	8	8	12	Missing impact on ecosystem functions. "The cascading effects of multiple climate-induced stressors on polar marine ecosystems impact their functions, structure, composition and dependent fisheries (high confidence) {3.2.3., 3.2.4} [European Union]
4080	SPM	8	8	8	8	Consider adding a couple of examples in addition to zooplankton -- for example from SROCC box 3.4 page 71, last paragraph, on changes and atlantification in the Barents sea). Consider adding a sentence on sea ice dependent species as well (SROCC box 3.4, second para). [Government of Norway]

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4322	SPM	8	8	8	8	Add "ocean" symbol [Government of Monaco]
4900	SPM	8	8	8	8	Ocean icon needs to show here. [Government of Germany]
4902	SPM	8	8	8	8	Please consider to add an explanation in brackets to the term phenology, as has been done for marine heat waves in line 33 (page SPM-5). [Government of Germany]
2760	SPM	8	10	11	8	The climate-change related stressors are not the only factors impacting marine ecosytems. They are combining with others human factors such as pollution and fishing to create an overall cummulative stress on the marine environment. Fisheries are mentioned only as being impacted, but fishing also has an impact in combination with climate change. I think it would be helpful to capture this here. Suggested addition: 'The cascading effects of multiple climate-change induced stressors, combined with other human induced impacts from pollution and fishing, are changing polar ecosystems and their ability to provide ecosystem services.' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4324	SPM	8	10	8	10	More editing: - do changes concern the size of the stock? the size of individu? - do the size raise or decrease ? [Government of Monaco]
6626	SPM	8	10	8	10	"cascading" has been used a couple times in the SPM to refer to ecosystem follow-on effects -- a concept that might not be immediately obvious to policymakers. Recommend adding a phrase that might be more illustrative -- e.g., "cascading food-web and competitive effects". [Government of United States of America]
616	SPM	8	10	8	11	The multiple climate-induced stressors have cascading effects impacting first polar marine ecosystems themselves, which then have consequences for the fisheries. The sentence could be re-balanced in that sense. [Government of France]
7862	SPM	8	11			The "impact" on fisheries should be somewhat qualified. The reference to "stressors" strongly suggests negative impacts, but are they qualitative (e.g., change in species), quantitative (change in stocks) or distributional? [European Union]
2730	SPM	8	11	8	11	Suggested addition if accurate: '...on polar marine ecosystems negatively impact fisheries' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4546	SPM	8	11	8	11	idem as above. Not only impacts fisheries, but the entire food web and trophic relations, ultimately affecting fisheries [Government of Belgium]
4906	SPM	8	11	8	11	Instead of "fisheries" we propose to use the term "fish populations", because this section refers to the impacts on ecosystem level (= fish population) and not yet the economic sector (fisheries). [Government of Germany]
3230	SPM	8	13	8	14	Missing words from this sentence? Unclear as written. Should it say “habitat expansion” and “species migration”? Or is this meant to refer to habitats encroaching inland? [Government of Canada]
1066	SPM	8	14			Suggest defining "rates of range shifts". [Government of Australia]
7864	SPM	8	14			Add "marine" before "plant and animal groups" [European Union]
618	SPM	8	14	8	14	We suggest to add "marine" before "plant and animal groups" in order to avoid ambiguity when using A5.3 alone. [Government of France]
620	SPM	8	14	8	16	Please check if "different plant and animal groups" is the right wording. Otherwise, please prefer "marine species" (as in chapter 5 p.5-44). If plant are benthic, it is assumed to be less than 200m [Government of France]
1202	SPM	8	14	8	16	The uncertainty assigned to the finding that “Rates of range shifts across different plant and animal groups since the 1950s are estimated to be 52 ± 33 km decade-1 and 29 ± 16 km decade-1 for organisms in the epipelagic and seafloor ecosystems, respectively (very likely).” is “very likely”. However, the uncertainty is not assessed for this finding in 5.2.3.1.1 of Chapter 5 on page 43 of the underlying report, which is suggested to be checked. [Government of China]
6628	SPM	8	14	8	16	Suggest replacing "epipelagic" with "surface ocean (0-200m)". [Government of United States of America]
4908	SPM	8	14	8	18	That marine organisms cannot migrate poleward forever to balance the increasing temperatures is important because this could take to their complete extinction or to important imbalances in species richness. These physical limitations for the poleward shifts (geographic barriers in semi-enclosed seas, lower oxygen water, hydrography gradients, etc.; see last paragraph of page 5-45 and first paragraph page 5-50) are not mentioned at all in the SPM but should be; A5.3 could be a good place to include them. Please revise. [Government of Germany]
6630	SPM	8	14	8	18	This point omits the fact that some marine fish are moving deeper instead of changing latitude. [Government of United States of America]
7728	SPM	8	14	8	18	Paragraph A5.3 could also deal with the relation between climate change and some invasive species in coastal and marine ecosystems similarly as the paragraph A4.1 discusses this phenomenon for the cryosphere. [Government of Spain]
8514	SPM	8	14	8	18	A5.3: Vital importance for Kiribati as added to the limited resources available for the population, an alteration of species distribution could have really severe negative effects in terms of resources. [Government of Kiribati]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4910	SPM	8	15			Please explain the expression "epipelagic" by a footnote or in brackets for non-experts or do not use scientific jargon at all. [Government of Germany]
2732	SPM	8	15	8	15	epipelagic' most likelt won't mean anything to the average policymaker, suggest this is explained in layperson's terms. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1346	SPM	8	15	8	16	Please specify in which direction these shifts have been observed [Government of Luxembourg]
3232	SPM	8	17	8	17	Presume this rate of sea level rise is for local sea level rise (vs global avg. sea level rise, which is reported as 3-4 mm/yr. on page 7). Clarification needed in text. [Government of Canada]
8414	SPM	8	18	8	18	After 'medium confidence', add: "The rate and direction of observed range shifts are shaped by the interaction between climatic and nonclimatic factors such as local temperature and oxygen gradients in the habitat across depth, latitude and longitude, and ocean currents (high confidence) (Chapter 5 in section 5.2.3.1.1)." [Government of Peru]
4326	SPM	8	20	8	20	"two Pacific" missing a word, eg. 'currents' [Government of Monaco]
6632	SPM	8	20	8	20	Remove "Pacific". [Government of United States of America]
2762	SPM	8	20	8	21	This section talks about how the California + Humbodt currents are being affected. Are projections of future changes in these currents over the 21st century available? If so suggest these are included in section B. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4912	SPM	8	20	8	21	Please delete "in the ocean" - it is confusing and not necessary. Also, it should probably read "the two Pacific of the four major upwelling systems" ("the" missing before Pacific). [Government of Germany]
6634	SPM	8	20	8	21	For the average reader, it would be useful to say why these currents are important (namely, they are the most productive regions in the world), and if it is just that there are sufficient data to only evaluate these two systems. [Government of United States of America]
8180	SPM	8	20	8	21	The line is confusing. May revise as "Increasing ocean acidification and oxygen loss are impacting two Pacific systems (California Current and Humboldt Current) of the four …." [Government of India]
622	SPM	8	20	8	22	Observational evidences are cited for California but not for the Humboldt, which acidification/desoxygenation is observed in climate change projections, not observations (Box 5.3). The two systems should be treated distinctively. [Government of France]
1348	SPM	8	20	8	22	Propose rewording to: Increasing ocean acidification and oxygen loss are impacting the two of the major Eastern Boundary upwelling systems in the Pacific Ocean (California Current and Humboldt Current) (high confidence). [Government of Luxembourg]
4136	SPM	8	20	8	22	First sentence of A5.4: Please consider moving this sentence to A2 since it states physical/chemical changes in the ocean, not impacts on ecosystems or species. [Government of Norway]
8300	SPM	8	20	8	22	This sentence is difficult to understand. A suggested rephrasing is: "Increasing ocean acidification and oxygen loss are impacting the California and the Humbolt Currents in the Pacific ocean, two of the four major Eastern Boundary upwelling systems. [Government of New Zealand]
4914	SPM	8	20	8	24	A5.4: The importance of this statement is not obvious for decision-makers. We suggest to add "They [Eastern Boundary upwelling systems] are among the world's most productive ocean ecosystems." from the full report {Box 5.3}. [Government of Germany]
4916	SPM	8	20	8	24	What about upwelling systems in the other oceans? Addressing only the Pacific seems unbalanced. If this is due to data limitations, please clarify (e.g. "have been observed in …"). [Government of Germany]
6066	SPM	8	20	8	24	This issue is already addressed by the International Maritime Organization (IMO) with the new Sulphur regulation effective January 1st, 2020. Cutting Sulphur emissions helps prevent acid rain, which means: less harm to crops, forests and aquatic species; and tackling ocean acidification. [Government of Saudi Arabia]
6636	SPM	8	20	8	24	Why is OA and O2 loss only discussed in terms of the Eastern Boundary systems? [Government of United States of America]
6638	SPM	8	20	8	24	KEY ISSUE [JARGON]: Suggest "Increasing ocean acidification and oxygen loss are impacting two of the four major Eastern Boundary Upwelling systems in the ocean (high confidence) in the Pacific (California current and Humboldt Curent). Ocean acidification and oxygen loss in the California Current upwelling system has altered primary productivity and ecosystem structure, with direct impacts on fisheries catch and species composition." [Government of United States of America]
6640	SPM	8	20	8	24	Might be worth noting that increased meridional wind stress in EBUS may partly compensate the reduced upwelling of nutrients, although there is not high confidence in these coastal wind projections. [Government of United States of America]
6642	SPM	8	20	8	24	The wording is a bit misleading. These are two of the WORLD'S four major upwelling systems, and they are the TWO Pacific systems. [Government of United States of America]
6644	SPM	8	20	8	24	This paragraph is awfully specific. What is the significance of Eastern Boundary upwelling systems and/or ocean acidification observed there? [Government of United States of America]

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7866	SPM	8	20	8	24	Please, consider adding examples from the Atlantic and from the Indian Ocean. [European Union]
7868	SPM	8	20	8	24	A5.4 is barely comprehensible to non-experts. Is it possible to provide a non-expert-suitable definition of the area (two of the four major Eastern Boundary upwelling systems)? Is the word "Pacific" really necessary? If so, where are the other two systems? How large or significant is the area affected? Also, 5.4 should be placed after 5.5 since 5.5 seems to provide the more general situation, of which 5.4 is a specific example. [European Union]
3224	SPM	8	20	8	25	Since the SPM is written for policymakers, this paragraph should begin with a more general statement about why it's important to know about the impacts of acidification and oxygen loss on ocean upwelling. Explain why upwelling regions are important. Then the particulars about effects in specific areas could be mentioned. [Government of Canada]
2734	SPM	8	22	8	23	suggested edit: '…upwelling systems are altering primary productivity, ecosystem structure, with direct negative impacts…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6646	SPM	8	22	8	23	Insert "has" before "altered". [Government of United States of America]
624	SPM	8	22	8	24	the California trend is difficult to attribute to climate change rather than natural variability, since the internally generated variability is large enough to mask the trends in eastern tropical Pacific (5.2.2.2.2) [Government of France]
1474	SPM	8	22	8	24	"Ocean acidification and decrease in oxygen level in the Californian Current upwelling system altered primary productivity.." Please check the reference to acidification and oxygen loss as main drivers of altered primary productivity here. Box 5.3 seems to suggest changes in ecosystem structure, which may well affect primary production indirectly, but the main driver of changes in primary production seems to be the wind forcing and the resulting changes in upwelling dynamics, as described in box 5.3. [Government of Italy]
6648	SPM	8	22	8	24	Statements in A5.4 related to findings from the California Current are inaccurate, largely because the coarse summary presents findings from the field and model projections in a similar way, attributes information on ocean deoxygenation to ocean acidification, and generalizes information on an oxygen minimum zone to the entire ecosystem. The authors should refer to the first sentences on page 5-76 and the middle of the last paragraph in the box on page 5-76. Suggest the second sentence of A5.4 be changed to: "Ocean acidification and the decrease in oxygen level in the California EBUS has progressed enough to put the system close to thresholds important for ecosystem productivity, structure, and composition. The expanding oxygen minimum zone in the California EBUS has altered ecosystem structure and fisheries catches (medium confidence). {Box 5.3}." [Government of United States of America]
7870	SPM	8	22	8	24	Include more information on the impacts of ocean acidification and loss of oxygen in the California Current, provide examples of the impacts to better illustrate the alterations in the ecosystems and productivity. [European Union]
1068	SPM	8	23	8	24	Suggest adding "lower " or "below average" ahead of catches. Can this be quantified (e.g. % decline range)? [Government of Australia]
8302	SPM	8	23	8	24	Suggest that "through their" is deleted, such that the last phrase reads: "…with direct impacts on fisheries through their catches and species composition" [Government of New Zealand]
7878	SPM	8	26			The text states "in many regions": it could be relevant to list those regions [European Union]
628	SPM	8	26	8	26	"in many regions": This is a very vague statement for the IPCC. Could this be precised? Or a percentage given ? [Government of France]
626	SPM	8	26	8	27	In the declines in the abundance of fish and shellfish stocks, do we know how to separate the causes of what is due to climate change, from what is due to catch fisheries it-self ? [Government of France]
2754	SPM	8	26	8	27	"In many regions, declines in the abundance of fish and shellfish stocks due to direct and indirect effects of global warming have already reduced fisheries catches" The high confidence in this statement should be added to strengthen this SPM statement (as per underlying report) [Government of United Kingdom (of Great Britain and Northern Ireland)]
4166	SPM	8	26	8	27	First sentence of A5.5: Is it possible to add a confidence level to this statement to strenghten the message? [Government of Norway]
8182	SPM	8	26	8	27	The first sentence of A5.5 is an important statement and needs to be provided with the degree of confidence level (high/medium/low). [Government of India]
8554	SPM	8	26	8	27	This statement contains no likelihood language, so implies you are 100% certain (statement of fact) that in many regions the declines of fish and shellfish stocks due to global warming have reduced fishery catches. Is this really intended as a statement of fact? This seems problematic given that two medium confidence statements follow in support. [Government of Switzerland]
2750	SPM	8	26	8	31	Is it possible to quantify the impact, i.e. changes in observed abundance? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4548	SPM	8	26	8	31	idem as above. A bit surprised to find this narrow interpretation of 'impact on ecosystems' [Government of Belgium]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4918	SPM	8	26	8	31	A5.5: We suggest to add an important finding from the full report {5.4.1, p.5-73}: "This suggest that climatic drivers and overfishing have interacted synergistically in impacting some fish stocks and their catches (high confidence)." This point is essential to justify C2.4 (policy recommendations for fisheries to rebuild stocks). [Government of Germany]
4920	SPM	8	26	8	31	“Abundance of some species has increased as a result of the expansion of suitable habitat (high confidence)”: Is this "increased" correct or should it be "decreased"? This sentence seems at odds with the first one in this paragraph (“In many regions, declines in the abundance of fish and shellfish stocks due to direct and indirect effects of global warming have already reduced fisheries catches.”). Please check and rephrase to add clarity. [Government of Germany]
6068	SPM	8	26	8	31	Another major factor contributes to the decline in abundance of fish other than global warming, which is called the invasive of harmful species due to the transfer of ship ballast water from one region to another. This issue has been addressed in the IMO's Ballst Water Management Convention (BWM), adopted in 2004. [Government of Saudi Arabia]
7872	SPM	8	26	8	31	A5.5 The paragraph overall appears to be stating that abundance of fish stocks / potential catch has decreased. However, the only high confidence statement is attached to the increase in abundance in some areas. The paragraph is therefore confusing and should be revised to reflect the overall balance of the situation. Also, as with other comments consider re-ordering so that assessments of historical changes in fisheries are placed alongside projections. [European Union]
7874	SPM	8	26	8	31	In point A5.5 there is no mention to the effects of climate change on the dispersion and spread of invasive species, but it might be an important factor for ecosystems´ resilience. This is widely mentioned through chapter 5. [European Union]
7876	SPM	8	26	8	31	It is unclear how, and to what extent, the imapct of climate change could be separated from other factors affecting fisheries and the oceans. How are their interactions taken into account? A number of the changes mentioned are quantitative (e.g., declines and increases of abundances), but there is no indication of the nature of the qualitative ones (e.g., "changes in species composition": in what way? What are the econoomic/ecological implications?) [European Union]
630	SPM	8	27	8	27	"Abundance of some species": Please specify the considered areas. Please consider giving examples. [Government of France]
6650	SPM	8	27	8	28	For readability, consider "Abundance of some species has increased owing to habitat expansion." [Government of United States of America]
632	SPM	8	28	8	30	Please add "studies" after "modelling" [Government of France]
634	SPM	8	28	8	30	As demonstrated in Chapter 5 section 5.4.1.1, the effect is particularly high in the tropics. Please add "...to an overall decrease in maximum catch potential (medium confidence), particularly in tropical oceans (high confidence)" [Government of France]
4922	SPM	8	33	8	36	A6 presents effects on coastal ecosystems in a very condensed way providing all the important keywords except the fact that shrinking coastal ecosystems are related to carbon emissions (last sentence of A6.1). That should be added in the headline statement, e.g. "Shrinking vegetated coastal ecosystems are associated with notable carbon emissions (high confidence)". [Government of Germany]
4924	SPM	8	33	8	36	A6. In addition to provisioning and regulating ecosystem services, the full report details supporting services of coastal ecosystems such as habitat provision for feeding, spawning or nursery grounds and others (chapter 5.4.1.3, page 78). The statement of the full report "Overall there is high confidence that marine habitat loss and degradation have already impacted supporting services from many marine ecosystems worldwide" needs to be better reflected in the SPM, ideally providing examples. [Government of Germany]
8676	SPM	8	33	8	36	Please add a sentence about coral bleaching (from A6.3 (page 9, line 5-7) in the summary in A6. [Government of Netherlands]
6652	SPM	8	34	8	34	"human activies" is vague in that it could refer to an entire suite of interacting anthropogenic impacts. Is this meant to refer to a specific aspect of anthropogenic global change or all of these human activities in general? [Government of United States of America]
7880	SPM	8	35	8	35	delete 'species'' rationale: biodiversity includes genes, species and ecosystems; [European Union]
4926	SPM	8	35	8	36	In the last sentence of A6 the message may be easier to read if the listing is slightly spitted: "Impacts are already observed on species level with consequences for biodiversity as well as ecosystem functioning and services (high confidence)...." [Government of Germany]
6654	SPM	8	35	8	36	This sentence does not make sense. Need to insert "and" before "ecosystem functioning", and the word "species" is kind of redundant with "biodiversity". [Government of United States of America]
7882	SPM	8	36			Given the rather generic nature of the sentence, could the statement not be made with a higher degree of confidence? It appears virtually certain that at least some impacts are already observed on the listed factors. [European Union]
4550	SPM	8	36	8	36	We suggest 'ecosystem' services instead of services. [Government of Belgium]
6656	SPM	8	36	8	36	A6 section summary reference should be 6.4.2.1 instead of just 6.4. [Government of United States of America]

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6658	SPM	8	36	8	36	The writing of heatwaves should be consistent; in previous pages it was written as one word, here it is separate. [Government of United States of America]
7884	SPM	8	38	8	40	The following statement from A6.1 is extremely powerful and policy relevant. It should lead the headline statement A6 "vegetated coastal ecosystems protect the coastline from erosion and help buffer the impacts of sea level rise [yet] nearly 50% of coastal wetlands have been lost over the 20th century since pre-industrial times". [European Union]
3228	SPM	8	38	8	47	Good context setting first sentence. It would benefit from the addition of text on the carbon sequestration service these ecosystems provide (as in Ch. 5 executive summary). This would provide a link to the last sentence in this para about carbon emissions associated with loss of these ecosystems. [Government of Canada]
3234	SPM	8	38	8	47	A6.1: there may be high confidence that the number is somewhere within this range (0.15–5.35 GtCO2 yr-1) but the range is very broad and the numbers at the upper end do not seem plausible. The rate of anthropogenic emissions and the rate of atmospheric CO2 growth are known, so it doesn't seem possible that this source could be this large. 5.35 Pg. CO2 = 1.46 Pg. C is about as large as the entire source from terrestrial deforestation. [Government of Canada]
4928	SPM	8	38	8	47	In A6.1 changes of the three important coastal ecosystem types are described quite well: coastal wetlands, seagrass meadows and mangroves show notable changes in several dimensions (area extension and shifts, biodiversity, stability). However, only for wetlands the human impacts are described in line with the effects of climate change. Why are the human impacts not named for the other two ecosystems? Seagrass meadows suffer from eutrophication and seabed-affecting activities; mangroves are often in spatial competition with human claims for settlements and aquaculture. This information should be provided at this point. [Government of Germany]
6660	SPM	8	38	8	47	This item mentions the negative impacts of shifts in the range of coastal vegetation (e.g., mangrove encroachment). Are there examples where such shifts have a positive effect (e.g., mangroves create more shrimp nursery habitat)? [Government of United States of America]
6662	SPM	8	38	8	47	It's not just vegetated coastal ecosystems that protect the coastline from erosion and buffer the impact of sea level rise. Coral reefs and oyster reefs are not vegetated and provide the same, if not greater, protection. These have been quantified by USGS (Storlazzi et al., 2017, 2019) and TNC (Beck et al., 2018; Reguero et al., 2018, Narayan et al., 2017). [Government of United States of America]
6664	SPM	8	38	8	47	Section A6.1 states that 50% of coastal wetlands have been lost over the 20th century. Later the first sentence in Section B6.2 states that 20-90% of coastal wetlands are projected to be lost by 2100. The word "remaining" or a time frame should be inserted in B6.2 in order for it to make sense. The second line in B6.2 also needs correction. It says that some coastal wetlands are "growing" where sediment supply is high and they can migrate inland. The next sentence and the last sentence in B6.2 again refer to migration, which is implied to be the only way wetlands can "keep pace with SLR". This key message neglects to mention that the "growing" of wetlands also occurs vertically through vertical accretion of sediments in place (migration not required). [Government of United States of America]
636	SPM	8	39	8	39	We suggest to provide more detailed geographical information on the coastal wetlands concerned [Government of France]
6666	SPM	8	39	8	39	Rather than say "nearly 50%" give exact figure. [Government of United States of America]
6668	SPM	8	39	8	40	Strike "since pre-industrial time". [Government of United States of America]
8304	SPM	8	39	8	40	Not sure that the sentence needs "since pre-industrial time". Suggest this is deleted, or the sentence be rephrased for ease of reading/understanding. [Government of New Zealand]
4930	SPM	8	39	8	41	50% loss refers to multiple drivers, which have considerably different contributions and can thus be misleading as to the causes of this loss. Please revise to be more specific/clear. [Government of Germany]
6670	SPM	8	39	8	41	"Nearly 50% of coastal wetlands have been lost over the 20th century since pre-industrial time, as a result of the combined effects of localised human pressures, sea level rise, warming and extreme climate events (high confidence)." Language is confusing. Have nearly 50% of coastal wetlands been lost over the course of the 20th century? Or were nearly 50% lost from the beginning of industrialized times to the end of the 20th century? Suggest rephrasing clearly. [Government of United States of America]
638	SPM	8	40	8	40	Please consider deleting "localised". Sometimes, human pressure are not so localised. [Government of France]
2736	SPM	8	40	8	40	do we know the proportional breakdown of different factors responsible in these 'combined effects'? If so it would be great to mention this here. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6672	SPM	8	40	8	41	The pre-industrial time is demarcated by ca. 1850, which is not completely the same as saying the 20th century. Further, are the almost 20 years of the 21st century included in the statement? [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6674	SPM	8	41	8	43	This sentence addresses a number of concepts and could be phrased more clearly, perhaps as follows: "Ranges of seagrass meadows and kelp forests are contracting at low-latitudes, WHICH CAN BE attributed to warming since the late 1970s (high confidence)." The second sentence refers to loss following heatwaves, but combines data from seagrass meadows (36%) and kelp forests (43%), both based on single studies. Suggest framing more broadly to avoid a narrow literature base. "SIGNIFICANT LOSS OF SEAGRASS MEADOWS AND KELP FORESTS HAS BEEN OBSERVED following heatwaves (medium confidence)." [Government of United States of America]
2738	SPM	8	42	8	42	Suggested addition: '…low latitudes, due to factors attributed to warming since the late 1970s (high confidence), and in some areas with a (permanent?) loss of…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
3226	SPM	8	42	8	43	Is the 36-43% loss of sea grass meadows and kelp forests following marine heatwaves a permanent or temporary loss? [Government of Canada]
6676	SPM	8	42	8	43	Revise "and in some areas with a loss of 36-43% following heatwaves" to "and some areas have experienced episodic loss of 36-43% in response to heatwaves" [Government of United States of America]
2746	SPM	8	43	8	43	It is not currently clear over what timescale the 'loss of 36-43%' of seagrass meadow and kelp forest range relates to. Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
640	SPM	8	43	8	45	Please add "While mangroves continue to be degraded and lost in specific regions, mangrove encroachment…" because mangroves face also serious threats. [Government of France]
6678	SPM	8	43	8	45	It may also be worth reflecting the net loss of mangroves globally (largely due to clearing/ conversion). [Government of United States of America]
6070	SPM	8	43	8	47	Many coastal areas have been planted, restored and covered by mangroves and in many countries. [Government of Saudi Arabia]
7886	SPM	8	43	8	47	Mangrove encroachment may be a relevant factor, but it is odd to mention it as an example of ecosystem loss. Mangroves themselves are imprtant habitats and they are on the decline. Their (spontaneous) expansion only reduces their overall (and mostly human-driven) loss. It is also unclear whether a replacement of open saltmarshes with mangroves is always negative on the balance, in particular in light of the following sentence addressing carbon loss. It sounds counterintuitive to associate the the expansion of mangroves with emissions from ecosystem loss. What seems clear (and, if so, should be emphasized) is that the human-driven loss of both mangroves and other coastal ecosystems have overall negative impacts on coastal resilience to climate change, exacerbating other factors. [European Union]
6680	SPM	8	44	8	44	Change "have" to "has". [Government of United States of America]
3236	SPM	8	45		47	This upper end of the estimated range of CO2 emissions of 5.35. GtCO2/yr from vegetated coastal ecosystems appears very high. The SOD of the SRCCL assessed that the likely range of emissions from all AFOLU emissions (which presumably includes coastal ecosystems) is 5.5 +/- 2.6 GtCO2 per year. So apparently the report assesses that the upper end of emissions from coastal ecosystems could be almost equal to the best estimate of all AFOLU emissions. In the underlying assessment (5.5.1.2.2) the very high upper end of the range comes from a single study - Lovelock et al. (2017) - with the next highest study having an upper limit less than half as large. Suggest that the authors considering reporting an assessed likely range, taking into consideration all available studies, rather than just taking the top end of the range from the study with the highest value. [Government of Canada]
8306	SPM	8	45	8	46	Change "carbon" to "carbon dioxide" unless this estimated emission is Gt carbon dioxide equivalent per year. If the latter, then change "carbon" to "greenhouse gas" and change "GtCO2" to "GtCO2e" [Government of New Zealand]
2740	SPM	8	45	8	47	Is this a direct carbon emission or loss of carbon sequestration potential? Or both? Worth clarifying here please. It would also be useful to put this in context i.e. it would be helpful to mention that annual emissions are around 42GtCO2 (as stated in SR1.5). [Government of United Kingdom (of Great Britain and Northern Ireland)]
4226	SPM	8	45	8	47	The finding that loss of vegetated coastal ecosystems is asssociatied with carbon emissions is an important finding that merits to be highlighted in the A6 shaded text (lines 33-36). [Government of Norway]
6682	SPM	8	45	8	47	Given the very wide range, it seems pretty strange to have it indicated as "high confidence", sort of like saying global warming will be between 0 and 10°C with very high confidence. The upper bound is well over 10% of global fossil fuel emissions. And is this net effect? Are new wetlands/coastal ecosystem growing in new regions? [Government of United States of America]
2756	SPM	8	46	8	46	Is it possible to include a central estimate for the carbon emission associated with loss of coastal ecosystems? The range here is very large at present. Are there other sorts of emissions we can compare this range to? It seems that at one extreme we are suggesting this is as a big an issue as tropical deforestation but at the other extreme, it is may not be such a major priority. This is unhelpful for policy design. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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2758	SPM	8	46	8	46	We have not been able to verify this statistic '(carbon emission associated with current rate of loss of vegetated coastal ecosystems is estimated to be 0.15-5.35 GtCO2/yr)' in the main report. The technical summary of Chapter 5 states: The carbon emission associated with the loss of vegetated coastal ecosystems is estimated to be 0.04–1.46 Gt C yr-1 (high confidence), which is inconsistent with the range presented here. Please clarify/check the SPM and the underlying report chapters are reporting a consistent value. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4932	SPM	8	46	8	46	Range is very broad but confidence is high - we understand what is meant here but maybe this is not the most effective way to communicate it. Could the authors find a different way to present this? [Government of Germany]
3464	SPM	8	46	8	47	What kind of range is this (all studies, some range?) - would a likelihood statement be feasible, rather that confidence level one? The range is rather huge, and it would be useful if it could be developed. [Government of Sweden]
2752	SPM	8	48	8	48	Is it possible to quantify extent to which this is attributable to anthropogenic climate change vs. other human pressures? [Government of United Kingdom (of Great Britain and Northern Ireland)]
642	SPM	8	49	8	50	We strongly welcome the mention of "increased sea water intrusion in estuaries due to SLR". [Government of France]
7888	SPM	8	49	8	51	The role of other factors, such as reduction in freshwater discharge and land subsidence, should be acknowledged. [European Union]
6004	SPM	8	49	9	2	A6.4 treats a sea water intrusion due to sea level rise, which is well linked with A6.4. Both paragraphs address the changes on the coastal ecosystems due to the sea level rise. It seems better to merge into A6.4, or two or move A6.2 to the front of A.6.4 for a contextual sequence of SPM, terrestrial cryosphere-->ocean-->coastal sea level. [Government of Republic of Korea]
8308	SPM	8	50	8	50	delete "biotic" - this is not necessary [unless there are species that are not biotic in nature] [Government of New Zealand]
2766	SPM	9	1	9	1	A non-expert is unlikely to know what eutrophication is. Please briefly define. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6684	SPM	9	1	9	1	"...leading to expansion of low oxygen areas (high confidence)" should read "...leading to expansion of low oxygen areas and concomitant acidification (high confidence)" [Government of United States of America]
644	SPM	9	2	9	2	Please consider mentionning the impact on coastal areas of melting cryosphere (increasing freshwater discharge, potential input of mercury previously stored in permafrost). It may provide additional stresses to coastal ecosystem [Government of France]
6686	SPM	9	2	9	2	6.4.2.1 is not relevant to the topic of A6.2 (sea water intrusion in estuaries). Do not include it in the bracketed references. [Government of United States of America]
940	SPM	9	4	9	11	Ecosystems in Small Island developing states should be included here as reference. [Government of Jamaica]
1436	SPM	9	4	9	11	What are there linkages between ocean heating /ocean heatwaves and freqeuncy and stregths of storms and tornadoes?? [Government of Denmark]
6688	SPM	9	4	9	11	A6.3 is unclear about whether it's supposed to be about marine heatwaves/extremes or acidification as well. Either downplay the acidification idea in lines 8-11, or rewrite the whole bullet to be more about extreme events including heatwaves and acidification. [Government of United States of America]
6690	SPM	9	4	9	11	A6.3 bracketed references should include 6.4.2.1. [Government of United States of America]
6692	SPM	9	4	9	11	Another example is a shift to smaller size zooplankton in the Bering Sea. This will have a negative impact on the marine food chain and commercial fisheries. [Government of United States of America]
8516	SPM	9	4	9	11	A6.3: Marine heatwaves afect severily to coral reefs, increasin bleaching rates. Many countries in the pacific depend on reef barriers to deter other significant events (waves, cyclones) and protect the coast for such events. More heatwaves=more coral bleaching=less protection. [Government of Kiribati]
2770	SPM	9	4	9	5	As this is for policy makers, the term "critical foundation species" should be explained as per Chapter 6 (pg 6-3) "...including critical foundation species such as corals, seagrasses and kelps" [Government of United Kingdom (of Great Britain and Northern Ireland)]
4934	SPM	9	5			What are "critical foundation species"? [Government of Germany]
132	SPM	9	5	9	5	Add some text explaining the term "critical foundation species" or include this term in the Glossary. [Government of Austria]
646	SPM	9	5	9	5	"foundation species" is not defined in the glossary. A short definition in the SPM would help decision-makers to understand which species are concerned her. [Government of France]
4552	SPM	9	5	9	5	Please add definition' foundation species' ? This does not seem to be a commonly used term. Does it refer 'habitat engineering species'? [Government of Belgium]
6694	SPM	9	5	9	5	What constitutes a "critical foundation species"? [Government of United States of America]
6696	SPM	9	5	9	7	Suggest either providing a brief example of a "critical foundation species" or directly connecting this to discussion of the coral bleaching events, if the idea here is that corals are foundational species for reef ecosystems. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
648	SPM	9	6	9	6	We suggest adding "ocean" before "warming" [Government of France]
2764	SPM	9	6	9	6	Has increased by how much? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7890	SPM	9	7			Is there insufficient evidence for a higher confidence level? It is generally taken as vitrtually certain. [European Union]
3466	SPM	9	7	9	11	Does this refer to climate change/impacts, or describes the ecosystems as they are under natural conditions? [Government of Sweden]
6698	SPM	9	7	9	11	KEY ISSUE [STRUCTURE]: As written, A6.3 is focused more on the various aspects of climate change (marine heatwaves, acidification) versus detailing the vulnerability of marine ecosystems to such change, which is expressed in the supporting chapter. Suggest an alternate emphasis as follows: "Marine ecosystems dominantly comprised of immobile, calcifying (e.g., shell producing) marine organisms (e.g., tropical coral reefs, temperate intertidal rocky shores) are each at elevated risk even under lower emission 1.5°C warming scenarios (high confidence). Marine heatwaves have already resulted in large-scale coral bleaching mortality events at increasing frequency since 1997, causing worldwide reef degradation (very high confidence) and further warming will likely pose high risk to both tropical coral reefs and rocky shore intertidal marine ecosystems (high confidence) resulting from thermal stress during marine heatwaves (corals) and prolonged desiccation events (rocky shores). Additionally, ocean acidification may further challenge both of these marine ecosystems and further limit their suitable habitat range (medium confidence) by inhibiting recovery rates through reduced rates of calcification, enhanced bioerosion, and effects on recruitment as demonstrated in both laboratory and field experiments including naturally occurring high-CO2 vent systems which approximate future conditions. {5.3.4, 5.3.5, Figure SPM.2}" [Government of United States of America]
1070	SPM	9	8			Suggest removing jargon: "sessile" [Government of Australia]
1476	SPM	9	8	9	8	"calcified organisms" could be replaced with "calcifying organisms" as this is an active process of the organisms themselves. [Government of Italy]
3238	SPM	9	8	9	8	This is one of many instances where technical language will be an impenetrable barrier to most non-specialist readers -- how many policy makers will know what "sessile calcified organisms" are? And even though examples are given in the parenthesis, the technical language will be a communication barrier for many. Nothing would be lost by simply saying "Similarly, organisms like barnacles and mussels in intertidal rocky shores ...". It would be really helpful (and appreciated by most readers) to make an editorial pass through the entire SPM with an eye to simplifying and compacting language. [Government of Canada]
7892	SPM	9	9			"A reduction in their biodiversity and abundance have been observed": Could "reduction" and "abundance" be illustrated by a figure? [European Union]
8310	SPM	9	9	9	9	Insert "and" before "a reduction" [Government of New Zealand]
8488	SPM	9	10	9	10	The last part of this sentence is conufsing. It could be mistakenly interpreted to mean that the acidification threatening these species is a natural event. [Government of Canada]
4328	SPM	9	13	9	13	To improve the continuity of topics, move this paragraph after the A6.2, aslo talking about sea level rise impacts on coastal ecosystems. The present A6.3 paragraph will then add another topic (marine heatwaves). [Government of Monaco]
4330	SPM	9	13	9	14	Other impact of sea level rise is salt contamination/salt water intrusion (of freswater ressources and arable lands). Mentionned in Chapter 4 but could be mentionned in Summary for Policymakers as well (in A6.2 or A6.4) This should rather be mentionned in A9. [Government of Monaco]
4554	SPM	9	13	9	14	We suggest to add 'species' before habitat contraction, los of current functionality and biodiversity but also...' : habitat contraction is in the context of a specific species or species assemblages; functionalities may change, so the loss is in the current status/diversity [Government of Belgium]
6700	SPM	9	13	9	14	The impacts of sea level rise on contraction, loss of functionality, and migration are intuitive. But it is not clear how sea level rise would cause the expansion of coastal ecosystems. Would this be in areas of flat topography, where tidal impacts extend farther inland? Suggest explaining or rephrasing. [Government of United States of America]
8518	SPM	9	13	9	14	A6.4: The text mentions habitat contraction, but one of the most serious impacts of sea level rise is the reduction of available soil/land those increasing the pressure for the habitats=more competition. [Government of Kiribati]
8614	SPM	9	13	9	14	First sentence needs editing, now expansion and migration create some confusion about what is meant. Other wording or add 'of species' after expansion and migration. [Government of Netherlands]
6702	SPM	9	13	9	19	Sentence is not grammatically correct and the last phrase directly contradicts the first. [Government of United States of America]
650	SPM	9	13	9	20	To improve the continuity of topics, please consider moving this paragraph after the A6.2, aslo talking about sea level rise impacts on coastal ecosystems. The present A6.3 paragraph will then add another topic (marine heatwaves). [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6704	SPM	9	13	9	20	This item mentions habitat expansion. Does this include restoration efforts? This is an important form of mitigation. [Government of United States of America]
8250	SPM	9	13	9	20	Useful paragraph for policy makers - please retain in SPM [A6.4] [Government of New Zealand]
7894	SPM	9	13	9	21	A6.4 should be placed immediately after A6.1 since it is more general message than A6.2 and A6.3 which are more specific cases. [European Union]
652	SPM	9	14	9	14	Please check the adequacy of the word "migration" as one may understand "seasonal movement of animals from one region to another". We suggest "geographical shift" [Government of France]
2768	SPM	9	14	9	14	Does the 'expansion, and migration' mean expansion and migration of whole ecosystems, or just habitats? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6706	SPM	9	14	9	14	Add "of some marine species"after "expansion and migration". [Government of United States of America]
6708	SPM	9	14	9	14	Remove comma after "expansion". [Government of United States of America]
6710	SPM	9	14	9	16	Explain what "land reclamation" is. [Government of United States of America]
7568	SPM	9	15			Could the term "land reclamation" be explained? It may not be clear to all readers. [Government of Finland]
654	SPM	9	17	9	17	" e.g." should be avoided in a spm. [Government of France]
3654	SPM	9	17	9	17	The -1 in year-1 should be superscripted [Government of Brazil]
6712	SPM	9	17	9	20	Should note that coral reefs and oyster reefs will not be able to vertically accrete quickly enough to keep up with fast rates of sea level rise projected for the latter 21st century. [Government of United States of America]
6714	SPM	9	17	9	20	This is a gross oversimplification and simply not true. Coastal vegetated wetlands and barrier shorelines have been rapidly transgressed and submerged during high rates of sea level rise during the Holocene and before. The greater than sign ">"should be changed to a lesser than "<" sign. [Government of United States of America]
6716	SPM	9	18	9	18	What is meant here by "coastal factors"? Insert "geomorphology and other factors that control the stability of coastal landforms and their capacity to accrete material vertically." [Government of United States of America]
4332	SPM	9	18	9	19	Mention should be made of the rapid anthropic destruction of mangroves due to coastal development, and that there are in danger. [Government of Monaco]
656	SPM	9	19	9	19	Please add "and estuaries" after "river deltas" [Government of France]
6718	SPM	9	19	9	19	Not clear that reader will understand what "coastal squeeze" refers to. Change term? [Government of United States of America]
7896	SPM	9	19	9	20	Sediment trapping and reductions in freshwater discharge are important issues that should be consistently mentioned where relevant (e.g., in A6.2). It should also be noted that the redction in freshwater discharge is at least partly due to climate change, either directly (increasing water deficits) or indirectly (increased water abstraction triggered by climate-induced factors). [European Union]
8252	SPM	10	0	10	0	Figure SMP.2: It is not clear in the legend what the black boxes that are either empty or with a dot symbolise. [Government of New Zealand]
1072	SPM	10	0			Suggest focussing on the key messages in this Figure – it is a complex figure with too many boxes. [Government of Australia]
1350	SPM	10	0			Figure SPM.2: This Figure is very difficult to assess. It is not possible to get an overall assessment of impacts in a region as: + and - signs have different meanings for physical changes than impacts; - the signs are difficult to read and the colors strike much more than the signs. Maybe a presentation in tabular form would be more useful. [Government of Luxembourg]
1352	SPM	10	0			The lower panel of the Figure does not give an overall picture of the sectors assessed, in particular on land, but only those assessed in this special report. If taken out of context of this special report this might lead to a misunderstanding, so we propose deletion of the lower panel. [Government of Luxembourg]
1204	SPM	10	0	10		Figure SPM.2, which is too complex for policymakers, is suggested to be simplified for an easier readability. [Government of China]
4334	SPM	10	0	10		Should be situated earlier in SPM.A, because illustrating the organization of the Summary for Policymakers by distinguishing pysical, ecosystemic, and human impacts. [Government of Monaco]
4336	SPM	10	0	10		This legend is not easy to understand. Better than a dot, a " +/- " can be more understandable. [Government of Monaco]
7900	SPM	10	0	10		Figure SPM2 is very difficult to read in its current form. It seems to me there are two options for improving it. Either convert to a table format (in order to keep all of the information), or else simplify drastically in order to retain as a diagram. The current format is essentially admitting that the information would be better presented as a table, since it requires readers to constantly switch attention between the two (!) legends and the diagram - and the additional of a dozen globes (to make it pictoral) adds very little value. [European Union]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7536	SPM	10	0	11		It is important to make figures with lot of information as easy to understand as possible. Among confusing features is that in "Human systems and ecosystems services" there are same categories (Tourism, Cultural services) or similar ones (Fisheries vs. Agriculture) but in different order in Ocean and Land (e.g. Tourism could be second in both). A reordering of either Ocean or Land categories to be in similar order would be helpful. Similarly, interpretation of "impacts on on ecosystems, human systems and ecosystems services" is not clear (e.g. is climate change affecting beneficially/adversely tourism or is it climate change impacts on tourism that has an effect on ecosystems). Also, it is not clear what land areas belong to Scandinavia. E.g., are Denmark, Finland and Svalbard included in Scandinavia? [Government of Finland]
4940	SPM	10	1			SPM.2 This Figure is challenging to read. While it conveys a lot of information in a very condensed format, it takes some time to comprehend what exactly is displayed. To our understanding, this Figure is actually a table in disguise - it does not really work as a visual, however it can work as a visually more appealing table, providing comprehensive reference in a regionally disaggregated way. The most important comment we have is that confidence levels need to be thoroughly checked against chapters, and also against each other for different categories; e.g. Ocean Acidification has high confidence across ocean regions, while T change has medium or is even inconclusive for some regions, which seems surprising given the observational records for both. Of course, it would be desirable if not only confidence in the observation but also strength of the effect was communicated. It may help readability if the legend was moved next to the row of globes, so that the reader doesn't have to jump between levels (sideways and upwards) but only sideways. Horizontal lines/shadings may also help to identify the category in question. If the globes were stacked in an offset arrangement, while the tables stayed in parallel, space might be gained to move the legend to the left. [Government of Germany]
4942	SPM	10	1			The graph presenting the already observed regional changes aggregated in several interesting clusters is a valuable part of the SPM. However, it is quite complex to read and may trigger misinterpretation. We propose reconsidering the aim of showing all regions; it is probably easier to take home a clear message of this figures, if there are chosen only a few examples in the graph (1-2 regions/ocean or land). [Government of Germany]
4944	SPM	10	1			Figure SPM.2 is overwhelming, it should be condensed [Government of Germany]
4946	SPM	10	1			a) The time period for the observed changes is missing and should be added. b) the assessment that warming of the upper 700m of the ocean is given as "medium confidence" for all regions can't be right in our view: the assessment of the exact rate of warming might be only likely, but the fact that the ocean has warmed is still a fact (virtually certain). That could obviously still vary across different regions, as for instance the North Atlantic shows varying patterns. But the Arctic ocean is only warming with medium confidence? We are wondering whether errors were made in translating the likelihood-scale into confidence assessments? The ocean temperature is "the" parameter which is best observed and known, much better than any other physical parameter, and the figure is not giving this impression at all. On the other hand, the very high confidence statement for pH is probably correct if related to the surface ocean only. However to avoid misrepresentation of what is known, the authors should please check the confidence statements for ocean temperature for the upper 700m. c) If EBUS are highlighted in this figure, than respective statements should also be part of the SPM text. [Government of Germany]
942	SPM	10	1	10	1	Figure SPM is suggesting that no data for tourism is available or it wasn't assessed and this is not true especially for Caribbean SIDS that rely heavily on the tourism sector for a larger portion of the GDP for those countries. [Government of Jamaica]
1074	SPM	10	1	10	1	Suggest clarification or deletion of the + and – in the final line. It is not clear why the + and - are in that line. [Government of Australia]
1076	SPM	10	1	10	1	Suggest clarification of the timescale for this figure: is it 20th century, since pre-industrial, since 1980? [Government of Australia]
1478	SPM	10	1	10	1	The figure is very comprehensive but rather difficult to understand. It is unclear how 'no change' is represented in the figure. [Government of Italy]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6720	SPM	10	1	10	1	KEY ISSUE [STRUCTURE]: This figure is very difficult to interpret. The coding of systems responses by region beg for dispute, because they are generalizations in terms of the directions and magnitude of response, and in terms of generalizing confidence level as well. Suggest deletion of this figure for numerous reasons. Editing this graphic in current form would not be feasible during the P-51 session. It would likely never reach a state that would make it acceptable. A defensible alternative would be a series of boxes with case studies of observed change in oceans and the cryosphere (from the document), as opposed to generalizations by region. Authors need to determine if inclusion genuinely adds value to the discourse. Here are some of the more notable shortcomings in Figure SPM.2: - There are no observed changes reported for Africa, though the underlying text has numerous conclusions about coasts and mountains of Africa. - The figure legends are very hard to understand and interpret by region. It is very confusing to glance at the upper left legend, in which all physical changes are orange, then see red as the first color in the first panel, and see red in the first sentence of the text legend. The three columns (physical, ecosystem, and human) can include both colors. Secondly, repeating the layout but changing parts of the legend in the bottom half was confusing. - The confidence color boxes could be made simpler: ""grey, grey, grey = low confidence"" ""light red, light green, light blue = medium confidence"" ""dark red, dark green, dark blue = high confidence"". - The EBUS does not include the West Coast of the U.S., which is an eastern boundary upwelling system. Placing EBUS region as the first region to notice (left on the first plot) is distracting as it has distinctive properties (e.g., temperature not +). At a bare minimum, the authors should place it on the right side to be consistent with Tropical Pacific. - Dissatisfied with many of the entries where the coding indicates no-data or not-assessed. For many of these empty boxes there was discussion in the SPM that is not captured in Figure SPM.2. For example, why are there are no projected impacts on rocky shores or cultural services in these systems? The graphic is not consistent with the narrative and does not contribute to flow of document. - In this figure a white cell means no data or not assessed. In some cases, another color is needed to indicate 'not applicable'. For example, for the Tropical Atlantic, 'polar benthos' is white, but it might be more descriptive to have it indicate 'not applicable' so that the white squares have more meaning - there are no data or it hasn't been assessed. Then there can be more focused attention on gathering the data or making the assessment for future reports. - Polar and high mountain impacts would need to be broken out separately to accommodate differences in these systems, as noted in line 7 below the figure. - The figure does not clearly distinguish between changes attributable to climate change and those that are due to other processes. If the changes listed are limited to those that are attributable to climate change, the title of the figure would need to be ""Observed regional changes in the ocean and cryosphere attributed to climate change and their impacts"". If the figure documents observed changes caused by any process, that would need to be made clear as well. - It is not clear if the changes in the ""Ocean"" panels of the figure refer to open ocean only (both open ocean and coastal are discussed in the document). - The plus and minus symbols combine the axes of physical changes and impacts. However what symbol would be listed for a physical increase that leads to a negative impact (e.g., for temperature)? [Government of United States of America]
1556	SPM	10	1	10	15	Figure SPM 2 - Presents assessment of the Observed regional changes in Ocean and cryosphere, Unfortunately Africa is not mentioned not reflected in the SMP, inspite the adequate availability of the documented impacts of Climate change on the Highest Mountain in Africa, Mt. Kilimanjaro and its Glacier. [Government of United Republic of Tanzania]
2774	SPM	10	1	10	15	The legend in figure SPM2 is not very clear or easily understood. For example, it's not clear what the dot and the blank box means. It should explicitly state that a dot means BOTH positive and negative effects are observed; or maybe 'mixed' effects are observed. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3240	SPM	10	1	10	15	SPM.2 Figure caption: recommend addition of text to the caption to explain the attribution of at least some of the physical changes on land (e.g. landslide, avalanche, subsidence) to rising GHG concentrations and associated warming. This will not be readily evidence to many readers. For Canada, if subsidence is referring to glacial isostatic rebound, then this should be not positive (increasing subsidence) for all of the Canadian coastline as there are areas (e.g. Hudson Bay and parts of the high arctic) where the land is rising not subsiding.) [Government of Canada]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3242	SPM	10	1	10	15	Fig. 2 Some clarification is required on the regions for North America. Does Western Canada/USA include the portion of Canada north of 60°N (i.e. Yukon Territory and western NWT) or is this included in a rather large (and rather diverse) region called Arctic Canada/Greenland? - clearly showing extent of regions would be helpful. It is unclear why Alaska is treated as a separate region and it has more in common with NW Canada (Yukon and western NWT) than NW Canada has with the rest of northern/Arctic Canada. For example substantial portions of AK and NW Canada are below tree line while the portion of Arctic Canada that mostly includes Nunavut is above tree line. For parameters like fire the way the regions are defined is important and the Yukon and NWT would more likely have greater fire frequency where as for the rest of Arctic Canada above tree line this would be less likely. It would make more sense to consider ecoclimate or physiographic regions rather than just political regions. [Government of Canada]
3244	SPM	10	1	10	15	Fig. 2 Mass movement might be a better term than landslide. Since it isn't clear how the North American regions are defined (see previous comment on Fig. 2), the potential for more mass movements such as thaw slumps and active layer detachments in Arctic Canada seems to be missing. Some of the examples given in Ch3 for e.g. come from NW Canada. Also you don't need to have mountains to have mass movement and slope failure - there are slopes elsewhere (e.g. approaches to streams) Also since definition of NW Canada not clear - may be missing potential for thaw settlement (subsidence) in NW Canada. [Government of Canada]
3246	SPM	10	1	10	15	Fig. 2 "Thaw settlement" would be a better term to use than "subsidence" to be clear that other types of subsidence are not considered here (including subsidence associated with loading from deposition, isostatic adjustments, extraction of groundwater, karst processes etc.) [Government of Canada]
3702	SPM	10	1	10	15	The figure could focus on key areas / issues and provide clear visual information for policy [Government of Ireland]
6724	SPM	10	1	10	15	KEY ISSUE [STRUCTURE]: This is an overly complicated figure to interpret which should be greatly simplified and/or the authors must ensure that the accompanying language in the text carefully walks the reader through it. [Government of United States of America]
7448	SPM	10	1	10	15	The assessment of “tourism” in Figure SPM.2 is not clear very much as the values may change both positively and negatively subject to the climate change impact. We would suggest changing the text from “tourism” to “tourist access”. [Government of Japan]
8556	SPM	10	1	10	15	Figure SPM2: this 'Tetris' figure has great assets, especially in terms of content richness. However, it is recommended to carefully consider whether in this current form it is really the right way to convey information to policy makers. The time needed to understand the figure could exceed the available time of (some) readers. The legend is not easy to capture and to translate into the figure. [Government of Switzerland]
6722	SPM	10	1	10	2	Here as elsewhere, suggest replacing "epipelagic" with "surface ocean (0-200m)". [Government of United States of America]

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Comment id	**Chapter**	**From page**	**From line**	**To page**	**To line**	**Comment**
848	SPM	10	1	11	2	Figure SPM.2 (p.10, l.1 to p.11, l.2) General comment We welcome figure SPM2 which is well thought out. It gives a good overview of a wide range of literature on cryospheric and ocean related topics and provides very relevant information. The adverse side of the great amount of interesting information provided is that the figure remains complicated to analyse rapidly. The figure is less usual than SPM1 for example, and therefore needs some time to be understood. We would like to draw attention on the potential reutilisation of this figure which may be difficult. Outside the SPM, we suggest to have subfigures for each region, and from which relevant information can be easily extracted. If the globes had to disappear from the SPM, we suggest to keep them for the suggested subfigures. Additionnally, please consider the following proposals to improve figure SPM2 even further. Globes - We strongly support the presence of a figure. However, please consider that a unique planisphere may be easier to read in the SPM and would take less space than 11 globes. The Mediterranean region should be considered as one additional ocean region. Colors - Please consider changing the colours. For colour-blind people, this figure is currently difficult to read because of the choice of colours. Legend - Please make a visual difference bewteen physical changes (increase or decrease) and « positive »/ « negative » impacts. We suggest to use arrows (head up for increase, head down for decrease) to avoid confusions in the interpretation of + and – for the physical changes. - Please consider better reflecting in the visual legend that « A dot represents both positive and negative impacts being observed. » Better than a dot, a " +/- " would be more understandable. Content -Please check the dot for temperature in the Tropical Pacific. We would have expected a « + ». - The figure suggests decreasing ice-associated ecosystems in the Arctic. Please check the consistency with the text of the SPM. It seems to contrast with the statement that NPP increases in the Arctic. Caption (l.15) The word "Tundra" is not appropriate for the tropical region where high altitude zones are made of grasslands/paramos. It would be preferable to add the term "...to tundra and to alpine and tropical mountain meadows" Additional information - The oceanic regions shown on the figure SPM.2 are very large. Please add regions as important as the Caribbean, the Mediterranean, and the West-Pacific
4250	SPM	10	1	11	2	"This is a very informative and important figure. It is also quite information dense and the graphic can appear somewhat complicated. Suggestions for improvement: * The colour red immediately seems negative, whereas greens seems positive. Could the negative changes be coloured red and the positive green, instead of + and -? Both positive and negative could be coloured yellow. As far as we can see the ""no change"" is not used in the figure. Then the categories (now orange, green and blue) could instead be distinguished by different shapes, for examples sircles, squares and triangles. The confidence level could be described by the outline of the shape, for example, bold solid line for high confidence, normal solid line for medium confidence and dashed line for low confidence. This would possibly simplify the legend. * Please consider to separate ocean and land with a line and perhaps a larger title. * In the leftmost figure at the bottom, two globes are overlapping. Could this be avoided if the southern Andes was included in the figure with Antarctica to the far right? " [Government of Norway]

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4252	SPM	10	1	11	2	There are several apparent discrepancies between this figure and the text, e.g. compare with A4.3 (p.7, l. 40-42) and the graphs on effects on tundra, where the text reports greening whereas the graph reports the sign for +/- or no change for all regions except Antarctica; A7 (p. 11, l. 7-8) and A7.1 (p. 11, l. 13-14) where it says, respectively, that there are mostly negative impacts on freshwater supply and negative effects on water quantity and quality in many Arctic regions, whereas the figure only shows negative effects on water availability for low latitude areas. Please check that the figure and the text are consistent with each other. If these "discrepancies" are intentional, please explain what the differences in findings come from (e.g. use of different data sets/analyses etc.). If they are mistakes, please amend. [Government of Norway]
4556	SPM	10	1	11	2	SPM2: why is the term 'consequences' and impacts used here instead of changes and impacts: please be consistent [Government of Belgium]
4558	SPM	10	1	11	2	SPM 2: the figure includes a terrible amount of information: it is difficult to read. [Government of Belgium]
4560	SPM	10	1	11	2	SPM 2: for the physical changes we suggest up and down arrows instead of + and - signs so that it is clear that + does not mean a positive impact. [Government of Belgium]
4936	SPM	10	1	11	2	Figure SPM.2 - Land: the caption does not explain what physical change in the Cryosphere refers to, this should be added. Also, for Antarctica, the observed Cryosphere change should be red, not orange - since this is referring to land only (inland ice, not sea ice). A1.1. states very high confidence for mass losses of Antarctica, therefore it is not consistent and also not in line with the chapter to have "medium confidence" here for observations. [Government of Germany]
4938	SPM	10	1	11	2	Figure SPM.2: It is almost impossible to understand this figure. The legend would benefit from a more detailed explanation on the meaning of the black boxes with and without white dot. The two boxes could both be represented in a single line to ensure that the reference on the right side can easily be attributed to one of the boxes. A dot represents both positive and negative impacts were observed. A black box without dot represents "no change". Generally, more encompassing explanations and a critical evaluation of the portrayed figures would benefit the SPM because they enable policy-makers to better understand and apply the given information. [Government of Germany]
2772	SPM	10	2	10	15	Figure SPM.2: Does the 'medium confidence' label given accurately reflect decreased change in the Antarctic cryosphere, despite plenty of obs suggesting so? Also maybe 'cryosphere' may be better labelled as 'land ice volume'to make the term less abstract to a policy maker. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6726	SPM	10	2	10	15	The boxes indicating high confidence for decreasing pH in the Southern Ocean are problematic. There are not that many long-term time series for oceanic inorganic carbon in the Southern Ocean and new data recently collected during the cold seasons add to uncertainties in the quantification of the carbon cycle in this region. In the West Antarctic Peninsula, there are no significant trends in carbonate cycle over the past 2 decades. There are so many gaps in the spatial and temporal coverage of data collection that it is hard to justify the change as high confidence. Although there are modeling studies that indicate decreasing pH, validating sea ice and primary production is really challenging as well. [Government of United States of America]
4338	SPM	10	2	10	2	Maps take room, while the geographical information they provide is not very usefull. For colour-blind people, this figure is difficult to read, due to the choice of colours. Suggestion: a table will be clearer. [Government of Monaco]
8520	SPM	10	2	10	2	Figure SPM.2:While there are three different indications for the Ocean Pacific, none of them makes reference to Central Pacific. Would be this considered the "Tropical Pacific"? [Government of Kiribati]
8226	SPM	10	8	10	11	repetitive. it is sufficiently explained in the legend. [Government of Austria]
8630	SPM	10	10	10	11	In the figure caption it is stated that “a dot represents both positive and negative impacts being observed". This suggests that positive and negative impacts are somewhat in balance, i.e. not 49 positive impacts and 1 negative impact. If that is not necessarily true, it might be good to highlight this. If some threshold was used (e.g. npositive:nnegative has to be between 0.5 and 1.5) disclosing that would be very informative. [Government of Netherlands]
7550	SPM	10	11			Figure SPM.2 explanatory text on line 11 appears to have an extra "is"-word which should be deleted to make that part of the sentence understandable. [Government of Finland]
4562	SPM	10	11	10	11	Changes are defined as: 'Temperature is change in 0-700 m layer'; We suggest : temperature REFERS to change in 0-700m layer [Government of Belgium]
7898	SPM	10	11	10	11	"Temperature is change" should be "Temperature as change" or just "temperature change" [European Union]
4340	SPM	10	11	10	12	"Temperature is changing" [Government of Monaco]
8202	SPM	10	11	10	12	correction - "Temperature changes in the 0 to 700m layer" [Government of India]

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3656	SPM	10	11	10	14	Replace "0-700m" with "0-700 m" and "200m" with "200 m" [Government of Brazil]
4094	SPM	10	13	10	13	Please note that cold water corals also occur as reefs. This sentence therefore does not give a true distinction between corals in warm and cold regions. "Warm water corals" and "cold water corals" are better terms to use, as is the case in figure SPM.3. It would also be useful if the same terms are used consistently through out the entire SPM. [Government of Norway]
7450	SPM	11	7	11	10	It is stated that “Changes in the teterrestrical cryosphere … have affected human societies through mostly negative impacts … with impacts and benefits…” Since benefits exist as stated, it is desirable to provide also some examples of positive impacts. [Government of Japan]
1428	SPM	11	7	11	11	The majority of studies on which the statement is based are community studies of climate change impacts on traditional livelihoods. This is not captured in the key finding, which talks about human societies broadly. Section 3.4.3.3.2 on economics acknowledges the difficulties determining the sign of the impacts in the Arctic. It also appears rash to conclude that negative impacts have been seen since the mid 20th century and link these to changes in the terrestial cryosphere. The point is that climate change exacerbates pressures on traditional livelyhoods, but also give rise to new opportunities for modern Arctic societies. [Government of Denmark]
2792	SPM	11	7	11	11	A7 states that benefits and impacts are unequally distributed across populations, but it would be helpful to specify if there are any trends in impacts. e.g. are poorer/vulnerable populations more or less likely to be disproportionately affected by impacts? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6728	SPM	11	7	11	11	This statement implies a single, common expectation for what an equal distribution of impacts and benefits should be, and that a different distribution would be unequal. However, there may be a range of different expectations for what "equal" distribution would entail, based upon a number of criteria. In any case, such an assumption would be normative. Therefore, suggest rephrasing the sentence to read: "Changes in the terrestrial cryosphere in the Arctic and high mountain regions have affected human societies through mostly negative impacts on freshwater supply, hydropower, infrastructure, transportation, food security, tourism and recreation, health and wellbeing, and culture and social values since the mid-20th century (high confidence). Impacts and benefits are projected to vary across populations and regions (<confidence based upon evidence>)." [Government of United States of America]
7902	SPM	11	7	11	11	The impact of changes in terrestrial cryosphere in the Artcic and high mountain regions on tourism and recreation is not so apparent for policymakers as tourism in the Artic keeps increasing fast and recreation in the Arctic and high mountain regions also seems to be on a growing trend. Should these negative economic impacts on tourism be confirmed, the underlying references in the background report should be emphasised as it is a counterintuitive impact. [European Union]
6730	SPM	11	7	12	44	The headline statement of A7 should clarify that changes are related to climate change, if this is indeed the case. If so, the statement would read: "CLIMATE-RELATED changes in the terrestrial cryosphere in the Arctic and high mountain regions have affected human societies through mostly negative impacts on..." [Government of United States of America]
4634	SPM	11	8	11	8	Increased precipitation in the northern high latitudes has rather positive impacts on freshwater supply amd hydropower. [Government of Russian Federation]
6732	SPM	11	8	11	8	Revise "through mostly" to "predominantly through". [Government of United States of America]
7904	SPM	11	9			The IPCC report notes that some major existing ocean economic sectors such as tourism (mentioned as well in Section B - p.19 / line 53) are at risk by climate change, and all sectors are expected to have elevated risks in the future. Nevertheless new opportunities for coastal tourism may occur, such as in the Arctic. Decrease in sea ice in the region is also opening economic opportunities for oil and gas exploration, mining industries and shipping (see Section A, p.11 / lines 41 to 44). This will pose additional risks from human impacts such as pollution and additional /acceleration of warming in the region. How to address the issue? this is where policy-makers would need insights if the international community is to fulfill its commitment to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" (Sustainable development Goal 14 of the 2030 Agenda) [European Union]
2798	SPM	11	9	11	9	Suggested edit: "cultural" rather than "culture" [Government of United Kingdom (of Great Britain and Northern Ireland)]
6734	SPM	11	9	11	9	"culture" should be "cultural". [Government of United States of America]
3248	SPM	11	10	11	10	It is good that the unequal distribution of impacts across populations is noted, but should be further qualified to note that Indigenous populations bear the brunt of the most severe negative impacts. [Government of Canada]
7704	SPM	11	12	11	28	combine these two paragraphs, they seem a bit repetitive. [Government of Spain]
4948	SPM	11	13			Please be provide a more specific statement than "negatively affected". In addition, given the vagueness of this statement we would assume that the confidence level would be "very high". [Government of Germany]

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1206	SPM	11	13	11	13	In order to enhance the textual accuracy, it is suggested that "snow" be replaced with "snow cover". [Government of China]
4096	SPM	11	13	11	19	We are not convinced that this text is balanced enough. It is expected that the density of game animals will increase during a warming. Has climate change affected agricultural productivity negatively or not, or are the socieconomic factors the most important? There are also examples that agriculture in the Arctic benefit from warming. [Government of Norway]
2794	SPM	11	14	11	14	It is unclear what is meant by 'local to landscape level changes'. This should be clarified or an approximate scale added to make it easier to discerne the difference between the two. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7452	SPM	11	15	11	15	The text “have disrupted access to, and food availability within, hunting, fishing, and gathering areas” is not clear enough. [Government of Japan]
6736	SPM	11	16	11	18	In more advanced agricultural regions, and in the shorter term, this relationship may be more correlational than causational. There are also temperature changes, changes in seasonality and patterns of precipitation, new pests, etc. [Government of United States of America]
8558	SPM	11	16	11	18	This statement is NOT supported by the assessment given in 2.3.1. In fact, there is no evidence given in 2.3.1 to support that there has been an observed decrease in glacier and snow meltwater in the regions listed here. The science certainly does not support such a generalised statement for High Mountain Asia. What major river basins of High Mountain Asia have experienced already a decline in glacier and snow meltwater? It is extremely problematic to generalise statements over such a large area, and even worse when the statement does not appear to be supported by underlying science. Note that section 2.3.1 does talk about observed decrease in runoff in low-latitude Andes, western Canada, and Swiss Alps, so perhaps these are the regions that should have been mentioned here? This appears to be a major error and needs to be corrected also in the Executive Summary of Chapter 2, where the same statement has appeared out of thin air. [Government of Switzerland]
2800	SPM	11	17	11	17	References to "socio-economic" are a bit dated. "Social" and "economic" should be separated out where possible. There is a tendency for people to read "economic" for "socio-economic" which diminishes focus on social aspects of climate change. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7454	SPM	11	17	11	17	It is a little hard to understand what are “other” climate drivers because it is not clear enough what climate drivers are already mentioned in the SPM text. [Government of Japan]
2776	SPM	11	17	11	18	do we have any rates of decline in agricultural productivity for specific regions that could be included here? [Government of United Kingdom (of Great Britain and Northern Ireland)]
1570	SPM	11	21	11	21	Not clear why the word spiritual has been used in this case . What is the key mesaage? [Government of United Republic of Tanzania]
6738	SPM	11	21	11	22	KEY ISSUE [CONFIDENCE]: In the first sentence of A7.2, it's surprising to see only 'medium confidence' in the impacts of the changing cryosphere on Indigenous peoples in the Arctic and mountain regions. With communities dependent on industrial activities that have been curtailed by the reduction in the season for ice roads/over tundra travel; communities impacted by coastal erosion (32 environmentally threatened communities in Alaska alone); by the threat to frozen food stores in the permafrost; and threats to infrastructure, the certainty should certainly be higher. [Government of United States of America]
6740	SPM	11	21	11	22	Cryospheric change impacts should be at least high confidence. [Government of United States of America]
7588	SPM	11	21	11	24	As there are other factors that also have impact on livelihoods, health, and spiritual, aesthetic and other cultural aspects of high mountain and Arctic communities, would it be possible for the authors to consider adding a statement on significance of the effects of cryosphere changes to those impacts? [Government of Finland]
658	SPM	11	21	11	28	It may be worth mentioning that a large population live in high altitude tropical mountains and directly depend on glacier. [Government of France]
4142	SPM	11	21	11	28	This point contains material that also fits within sections C2-C4 on Options and Enablers. Please consider moving. [Government of Norway]
8228	SPM	11	21	11	28	there is basically no information on mountains in the bullet apart from a rather random mentioning of mountain regions in the first sentence and at the very end. In turn, most links are to Ch2 sections. More consistency is needed in this bullet. [Government of Austria]
2802	SPM	11	22	11	22	Health is not a "cultural" issue. It is "social". Suggest the sentence is rephrased to make this clear. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2778	SPM	11	23	11	23	Suggested edit: 'have included a spread and growth of food- and...' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6742	SPM	11	23	11	23	nutrition "deficiency"? [Government of United States of America]
7456	SPM	11	23	11	23	It is suggested to replace the word “nutrition” with “malnutrition”. [Government of Japan]
7908	SPM	11	24			Delete comma after "Arctic" [European Union]
6744	SPM	11	24	11	24	What does the word 'supports' mean in this context? This is a vague statement that does not add value. [Government of United States of America]
6746	SPM	11	24	11	24	Delete comma after "Arctic". [Government of United States of America]

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3250	SPM	11	24	11	27	Very encouraging to see the recognition of Indigenous knowledge in supporting adaptation strategies in the Arctic. However, Indigenous Peoples, particularly Inuit, are LEADING adaptation action, not only supporting adaptation. Many of the examples listed here are led by or partnered with Inuit/Indigenous organizations (e.g.. the regional Land Claims Organizations in Canada) and it is important to communicate this leadership and self-determination piece. Perhaps the last sentence starting with "Indigenous knowledge..." should change to something like "Arctic Indigenous Peoples, including Inuit and Sami, are active leaders and partners in adaptation action and Indigenous knowledge in Arctic and mountain regions supports adaptation." [Government of Canada]
7906	SPM	11	24	11	27	This sentence should be moved to section C. [European Union]
6748	SPM	11	24	11	44	There are a couple of mentions of adaptation measures in this section (lines 24-26 and 43-44) that seem a bit out of place because there are not adaptation efforts described for most of the impacts mentioned here. [Government of United States of America]
6750	SPM	11	26	11	26	Define "Indigenous knowledge". [Government of United States of America]
808	SPM	11	26	11	27	Indigenous knowledge could be a bit more discussed here. We suggest: -mentioning that "Loss of indigenous knowledge in Artic and mountain regions undermines adaptation (medium confidence)." - mentioning the necessity to include indigenous knowledge to support adaptation Two sentences could be made. [Government of France]
6752	SPM	11	26	11	27	Presumably this sentence means that Indigenous knowledge is of value to the development of effective adaptation. This is an appropriate message. The alternative reading, however, is that Indigenous knowledge prefers adaptation, which is problematic ("knowledge" cannot prefer specific actions). [Government of United States of America]
6754	SPM	11	26	11	27	The rest of the document references both local AND indigenous communities as two binary entities that are both impacted by climate related changes. Not sure why the reference in this section only speaks to "indigenous knowledge." For consistency it would make sense to reference both. [Government of United States of America]
8254	SPM	11	26	11	28	We support the recognition of the role indigenous knowledge plays in adaptation [A7.2] [Government of New Zealand]
660	SPM	11	30	11	32	This remark could also be applied to mountain cryosphere : mountain activities have to be adapted (seasonality and paths), and infrastructures are threatened by the thawing of permafrost. See {2.3.4} and {2.3.5}. This sentence may be adapted to include also mountain cryosphere. [Government of France]
3252	SPM	11	30	11	34	Another example of inappropriate use of confidence language. All three sentences are statements of fact - they are binary true/false statements that can be proven/disproven by a single example (there is no judgement or assessment implied), and so confidence qualifiers are essentially meaningless. [Government of Canada]
3254	SPM	11	30	11	34	The wording 'Arctic peoples' is problematic here. This should change to 'Arctic Indigenous Peoples' or Arctic inhabitants, especially Indigenous Peoples,...' [Government of Canada]
6756	SPM	11	30	11	34	The authors may consider including information on what has been accomplished through these adaptation measures, and provide more detail on the problems and challenges faced by Arctic peoples, such as finding locations to relocate. As a summary statement, this seems far too sanguine than is the actual situation. [Government of United States of America]
3256	SPM	11	31			ice travel is specified, Is there any (or no) evidence that land travel over degrading permafrost areas is also becoming problematic? Should this be mentioned as a possibility? [Government of Canada]
2780	SPM	11	31	11	31	Suggested edit: 'and safety of ice travel conditions..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
2786	SPM	11	32	11	33	It would be helpful to include information on feasibility and effectiveness of these actions. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7910	SPM	11	33	11	33	What is meant by "cooperating agencies"? Please clarify. [European Union]
2788	SPM	11	34	11	34	Cross-chapter box 9 appears to have been removed from Chapter 3. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3468	SPM	11	36	11	39	Please add a confidence statement. Also, the statement on impacts on operation and energy production is unclear as to what such impacts have been and whether "limited evidence" refers to no-impacts in many cases, or that there are not very much data. Please clarify. [Government of Sweden]
8560	SPM	11	36	11	39	Section 2.3.1 does not seem to discuss implications for hydropower generation. Suggest that section references are carefully checked in all instances. [Government of Switzerland]
6758	SPM	11	36	11	40	What about impacts of increasing temperatures on water used for cooling at power plant (or industrial) facilities? [Government of United States of America]

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6760	SPM	11	41	11	41	"recreation" should be "recreational". [Government of United States of America]
1078	SPM	11	41	11	44	Suggest Adaptation measures for alpine tourism that have been adopted for ski tourism can also include geographic diversity, i.e. business models in the southern and northern hemisphere ski fields to reduce the vulnerability of climate change on the business model. [Government of Australia]
4208	SPM	11	41	11	44	This point contains material that also fits within sections C2-C4 on Options and Enablers. Please consider moving. [Government of Norway]
662	SPM	11	43	11	43	"Artificial snowmaking": Aren't there any negative impacts on the environment ? Please put some word of caution against that 'effective artificial snowmaking in many places'. Artificial snowmaking has issues in terms of the resource cost (limiting profitability of ski resorts), use of energy/ electricity to produce the snow (unless electricity is produced by 'clean energy', it increases GHG emission) and, a bigger concern, the water required (sometimes pumped from groundwater, or exacerbing water use conflicts). There are a number of reports and litterature on that topic. [Government of France]
4342	SPM	11	43	11	43	Put some word of caution against that 'effective artificial snowmaking in many places'. As we all know, artificial snowmaking has issues in terms of the resource cost (limiting profitability of ski resorts), use of energy/ electricity to produce the snow (unless electricity is produced by 'clean energy'. This increases GHG emission) and, a bigger concern, the water required (if it is pumped from groundwater it does not help!). There are a number of reports and litterature on that topic. [Government of Monaco]
6006	SPM	11	43	11	43	According to the context, "Artificial snowmaking" seems to be presented in a good way. However, this is a somewhat consuming method as it can not be widely used in the tropics. So I suggest that the sentence should be constructed with the idea that while this method("artificial snowing") can now be perceived as effective, a more efficient method or a fundamental solution needs to be implemented. [Government of Republic of Korea]
6762	SPM	11	43	11	43	Suggest replacing "Artificial snowmaking" with "Snowmaking technology". The snow is not artificial per se. [Government of United States of America]
7912	SPM	11	43	11	43	The report qualifies artifical snowmaking as an effective adaptation measure for sustaining ski tourism. Artifical snow cannot be a sustainable alternative to natural snow because of its impacts on natural resources, notably on water and soils. In addition, it involves considerable energy use and risks locking in high-emission, non-essential activities, often with questionable long-term viability. It should be deleted as an example of a successful adaptation option, or should be carefully qualified, highlighting the high risk of maladaptation. [European Union]
2782	SPM	11	43	11	44	Point B7.5 states that artificial snow-making will become less effective even at 1.5°C of warming. Point A7.5 as written could give the misleading impression that it will continue to be an effective form of adaptation. "Artificial snowmaking has so far been effective in many places as an adaptation measure for sustaining ski tourism, but is not expected to remain effective as temperatures increase" might be more appropriate wording. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2796	SPM	11	43	11	44	Is there any evidence showing the environmental impact of generating artifical snow? If so it might be worth including a sentence to temper the suggestion that the production of artificial snow is entirely a good thing. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4950	SPM	11	43	11	44	Please revise or delete these lines. Artificial snowmaking has severe environmental impacts and high energy requirements, leading to GHG emissions. It is not a sustainable option and should therefore not be portrayed as an appropriate and effective adaptation measure. It is also not effective in low-lying areas, and increasingly maladaptive with rising temperatures (cf. B7.5/2.3.5, 2.3.6). [Government of Germany]
7458	SPM	11	43	11	44	We would suggest adding some words to the second paragraph as follows: “Snow management methods such as artificial snowmaking has been effective in many places as an adaptation measure for sustaining ski tourism, when environmental conditions and economic costs are met.” We are afraid that the current second sentence picks up a part of the explanation in section 2.3.5. Our preference is covering the key message in 2.3.5 more generally. We understand 2.3.5 discusses the effectiveness of snow management method as adaptation and that one of the main methods is artificial snowmaking but this is only effective when various conditions are met. [Government of Japan]
4344	SPM	11	44	11	44	How can is be medium confidence if already effective in many places? [Government of Monaco]
7916	SPM	11	46			Replace "ecosystem services" with "ecosystems and their services". [European Union]
664	SPM	11	46	11	46	Please consider using "anthropogenic-related climate changes". Rising CO2 has led to increase ocean acidity impacting marine ecosystems [Government of France]
7460	SPM	11	46	11	47	It is stated that “Climate-related changes in the ocean have modified or degraded marine ecosystem services.” However, it seems in some cold areas marine ecosystem services have been enhanced by climate change. Thus, we suggest that this sentence would be modified so that positive effects also exist. [Government of Japan]

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7914	SPM	11	46	11	49	The impacts of climate-related changes in the ocean on tourism, trade and transport is referred to without indicating whether such impact contributed to increase tourim and trade and transport (in the Arctic for instance) or reduced such activities. Such information would be policy relevant. [European Union]
4346	SPM	11	46	11	50	A bit more editing is excepted on impacts on Fisheries. For some countries, eg. SIDS, this is a huge issue, both in terms of economic development and in terms of livelihood. Also there are considerable differences between, eg. commercial fish stocks such as tuna, coastal fisheries catches, aquaculture, of shellfish collection. Except for A8.1 which focuses on mostly on governance, there is little in terms of coastal fisheries, mariculture/ aqauculture. Eg some of the 'adaptation solution' promoted in the Pacific is to invest in mariculture of species that sequester carbon and/or nitrogen (seaweeds, giant clams, pearl oysters, edible oysters). [Government of Monaco]
6764	SPM	11	46	11	50	A8 summary text includes references to 6.3, 6.4, and 6.8 but none of these references appear in A8.1, A8.2, or A8.3 subsections. [Government of United States of America]
6766	SPM	11	46	11	50	A8 summary text makes reference to indigenous culture but there is nothing in A8.x that refers to indigenous people or cultures. One option is to include a reference to 6.4.2.3 where a reference to reduced access to indigenous hunting grounds during MHWs is described. [Government of United States of America]
6768	SPM	11	46	12	18	An argument could be made for adding a reference to 6.3 in A8 via Super Typhoon Haiyan since "impacts were worsened by thermodynamic effects on SSTs, SLR, and storm surges due to climate change (Trenberth et al., 2015)". Impact on "wellbeing" is justified because C6 states that it was the "Deadliest and most expensive natural disaster in the Philippines." [Government of United States of America]
7918	SPM	11	47			Insert "and aquaculture" at the end of the sentence, to read: "...on fisheries (high confidence) and aquaculture." [European Union]
3470	SPM	11	47	11	48	"Fisheries" would seem to have relevance for "food". Please clarify the distinction here, is some other aspects of fisheries considered, than as source of food? [Government of Sweden]
7920	SPM	11	48			"indigenous" should not be capitalised. [European Union]
2790	SPM	11	48	11	48	suggested edit: include food security...' Also, does 'Indigenous' need to be capitalised? [Government of United Kingdom (of Great Britain and Northern Ireland)]
2804	SPM	11	48	11	48	The use of the term "Food" is quite vague here. Is this "food security", "food availability", "food habits", etc? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3258	SPM	11	48	11	48	It is not simply Indigenous culture that is impacted but Indigenous lives and livelihoods. Suggest adding "and livelihoods" after 'Indigenous culture' here. [Government of Canada]
4564	SPM	11	48	11	48	We suggest to add 'provision (ecosystem service)' after food. [Government of Belgium]
4566	SPM	11	48	11	48	The underlying report refer to 'local and indigenous people' or 'local and indigenous knowledge', so clearly not only about 'indigenous' (CH 4 page 107, CH4 page 116, reference Hiwasaki et al 2105,...)'indigenous culture': is it also about 'local identity' or 'local traditions'? [Government of Belgium]
7922	SPM	11	49	11	49	Please say "tourism and recreation" (because, for example, skiing is not only a touristic activity, think on local inhabitants). [European Union]
6770	SPM	11	52	11	52	Revise text to "...spatial distribution and abundance AND TIMING of fish stocks..." [Government of United States of America]
2784	SPM	11	52	11	53	Has the challenge led to losses in catches or reductions in economic benefits? Could you be a bit more explicit about the impact? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4246	SPM	11	52	11	53	It could be useful if the text could list some notable examples of where warming-induced changes in distribution and abundance of fish stocks have alredy challenged the management of some important fisheries. [Government of Norway]

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6008	SPM	11	52	12	19	Moreover ecosystem services are addressed in the A8, sub contents do not address ecosystem services. However ecosystem services were addressed comprehensively in the SPM of SOD. It seems better to insert the A2.6 of SOD or new paragraph which addresses the climate change impacts on ecosystem services. Below is the A2.6 of SOD; 『A2.6 The role of ocean ecosystems in climate regulation, in support of human livelihoods, food security, culture and recreation and their intrinsic values that are important for human well-being, are threatened by climate change (high confidence). The evidence for these threats to human wellbeing includes: decline in biodiversity and ecosystem function (medium confidence), reduced quality and quantity of tourist attractions including coral reefs, as well as damage from more severe storm events, decreases in nutrient cycling in deep seafloor ecosystems (high confidence), reduced carbon sequestration and loss of carbon stocks in saltmarshes, loss of educational opportunities, and negative impacts on Indigenous knowledge and culture (medium confidence). {5.4.1, 5.4.2}』 [Government of Republic of Korea]
4952	SPM	11	52	12	4	A8.1: We suggest adding: "The food security and livelihoods of coastal communities, particularly in low latitude developing regions, are particularly vulnerable to decreases in potential fish catches and seafood supply (medium confidence)," see full report p.5-84 & p.5-88. [Government of Germany]
6772	SPM	11	52	12	4	Warming-induced changes in the spatial distribution and abundance of not only fish stocks but also invertebrates (lobster, clam) and marine mammals (seals, walrus) are economically important. References to 6.4.2.1 and 6.4.2.3 can be added to A8.1 along with the additional explicit mentioning of invertebrates and marine mammals that affect economic livelihood, culture, etc. This comment assumes that "fish stocks" is not a catch-all term that includes invertebrates and marine mammals. [Government of United States of America]
666	SPM	11	53	11	53	Please consider adding "And aquaculture". The word "fisheries" is sometimes used alone sometimes with the word "aquaculture". There should be a consistent wording along the text mentioning "aquaculture" where this activity is relevant. [Government of France]
4348	SPM	11	53	11	53	Fisheries "and aquaculture" (to add). Curiously, the word "fisheries" is sometimes used alone sometimes with the word "aquaculture". There should be a consistent wording along the text mentioning "aquaculture" where this activity is relevant. [Government of Monaco]
2816	SPM	12	0	22	0	Suggest that section B includes information about the long-term (post-2100) outlook for the Greenland ice-sheet. Can it be saved? If so, how? There is relevant material on page 55 of Chapter 4. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8652	SPM	12	0	15		We would like an elaboration of the issues addressed in A3.6 (especially wind and cyclones) in the B section 'Projected Physical Changes'. What is to be expected with regards to changes in extreme wind conditions? [Government of Netherlands]
6774	SPM	12	1	12	4	This statement, while possibly true, is very confusing as drafted. What does it mean to challenge the effectiveness of a national or international governance system? There are multiple factors that will determine whether the objectives listed in the paragraph will be achieved and, hopefully, the governance system will have to account for all factors to be successful. The SPM would do better by providing more relevant information on both the reasoning for climate change to be a primary challenge for these systems and the scientific basis for making such a claim (according to observed changes, projections from models, etc.). Figure SPM.2 provides little to no useful information to support this paragraph, providing further grounds to delete the graphic. [Government of United States of America]
8416	SPM	12	4	12	4	Add at the end "and should be improved in order to decrease the risks (5.4.2.2.2, 5.5.2.2.3)" [Government of Peru]
3704	SPM	12	6	12	11	Are data availble on the extent and rates of changes of algal blooms [Government of Ireland]
6776	SPM	12	6	12	11	A8.2 should have reference to 6.4.2.1 because that section discusses several examples of harmful algal blooms (HABs) associated with MHWs. [Government of United States of America]
2806	SPM	12	6	12	6	range expansion and increased frequency of HABs - can these be quantified? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4568	SPM	12	6	12	6	Please include a reference to HAB in the section on 'observed impacts on ecosystems'. Fits in section A5.1 on phytoplankton blooms. [Government of Belgium]
7924	SPM	12	7			Insert reference to nutrient run-off to read: "non-climatic drivers, such as nutrient run-off from agriculture" [European Union]
6778	SPM	12	7	12	9	Strike 'acidification' from the list as there is no current literature available to support it. It is also not supported by the content in Chapter 5. [Government of United States of America]
7552	SPM	12	8			Wording "loss oxygen" should be either "loss of oxygen" or "oxygen loss". Furthermore, it would be good to have a definition for oxygen loss, i.e. is it complete anoxia or hypoxia. The term "oxygen loss" appears in other places, e.g. on page 14, line 48. [Government of Finland]
4570	SPM	12	8	12	8	"Loss oxygen" - should read 'loss of oxygen' or 'oxygen loss' [Government of Belgium]
6780	SPM	12	8	12	8	Insert 'of' between "loss" and "oxygen". [Government of United States of America]
7926	SPM	12	8	12	8	loss oxygen - should be - oxygen loss [European Union]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8312	SPM	12	8	12	8	Insert "of" before "oxygen" such that it reads "loss of oxygen" [Government of New Zealand]
7928	SPM	12	10			Please elaborate or reword "poorly monitored". Monitoring is only relevant to vulnerability only if certain strong conditions are met (e.g., the monitoring results are made available to the population concerned, they have the ability to respond or the government intervenes to reduce vulnerability). [European Union]
6782	SPM	12	10	12	11	Revise the term "poorly monitored" to be more specific. Suggest using more precise language directly from page 5-81 of the underlying report: "Human communities in areas that lack local scale sustained monitoring programs and early warning systems are among the most vulnerable to these biological hazards." [Government of United States of America]
8230	SPM	12	10	12	11	this sentence sounds awkward; if as monitoring had an effect on vulnerability. [Government of Austria]
944	SPM	12	13	12	18	Changes resulting from Arctic ship-based transportation and tourism has ripple effects for shipping in the tropics and should be highlighted here. [Government of Jamaica]
6072	SPM	12	13	12	18	IMO regulates shipping globally, and there specific conventions, regulations and codes specific for Arctic and Polar regions. [Government of Saudi Arabia]
7930	SPM	12	15	12	16	Implications of increased ship-based transportation and tourism are referred to without mentionning the increased revenues associated to the increase of such activities. Such revenues may be short-term profits only but are a facts that have an influence on the local population views on climate mitigation policies. Such facts should be reffered to as some litterature touches on this issue [European Union]
6784	SPM	12	15	12	18	Does this statement concern observed or projected implications and risk increases? Revise to include information on observed impacts of increased Arctic-based ship transportation. [Government of United States of America]
7932	SPM	12	16	12	16	Please, add a level of confidence after "... shipping corridors". [European Union]
8232	SPM	12	16	12	16	also is inappropriate since the before mentioned changes are not necessarily negative. [Government of Austria]
6786	SPM	12	17	12	17	"regulations" is too limiting. Suggest something broader -- e.g., "policies" or "protections". [Government of United States of America]
7934	SPM	12	19			New paragraph: Authors may want to consider inserting a new paragraph A8.4 dedicated to the invasive species or species change under evolving climatic conditions. [European Union]
2808	SPM	12	20	12	26	Approximately what percentage of the global population in coastal zone is currently protected? This would be useful context for a policy maker to know if available. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3260	SPM	12	20	12	26	Another example of a factual statements (no judgement or assessment) having inappropriate confidence qualifiers. Such qualifiers should be removed in instances where they are not required. [Government of Canada]
4954	SPM	12	20	12	26	A9 only mentions large infrastructure projects as an adaptation measure, but not the potential impacts of climate change on existing, vulnerable coastal infrastructure. Have no impacts on coastal infrastructure been observed as of yet? Please revisit Chapter 4 and revise accordingly. [Government of Germany]
6788	SPM	12	20	12	26	6.8 appears in the bracketed A9 references, but it is 6.9.1 that is actually referred to in A9.2. [Government of United States of America]
4956	SPM	12	20	12	44	Section A.9 refers to coastal risk to people, and references section 4.3.3 of the underlying report. We have an editorial comment on a para in 4.3.3, page 4-75 that states: „At a European level, the number of people living in the 100-year coastal floodplain can vary between 20% and 70% depending on the different inundation models used and the inclusion or exclusion of wave set up (Vousdoukas, 2016).” This sentence is highly misleading because it could it be understood that 20-70% of the population lives in flood-prone areas, while the range refers to the difference between models. Therefore, please amend this sentence as follows: "At a European level, the difference in the number of people living in the 100-year coastal floodplain can vary between 20% and 70% depending on the different inundation models used and the inclusion or exclusion of wave set up (Vousdoukas, 2016).” [Government of Germany]
4572	SPM	12	22	12	22	"extreme water levels are rising": is it the frequency of extreme water levels? The intensity? The height? [Government of Belgium]
668	SPM	12	22	12	23	Please add a mention to human-induced (non-climatic) vertical land motion. For example, we suggest adding "and due to human-induced (non-climatic) vertical land motion (ex groundwater or hydrcarbon extraction)" after "to mean sea level rise" [Government of France]
6790	SPM	12	22	12	23	Include the effect of locally increasing tidal ranges as well as sea level rise on extreme water levels and tidal flooding due to navigational channel deepening and harbor improvements, increasing penetration of tides up rivers, degradation, displacement and disappearance of barrier islands, etc. (There is an absence of papers on these subjects in the reference lists.) [Government of United States of America]
1430	SPM	12	23	12	23	"Although" seems to regret focus on extreme events. Delete "although" [Government of Denmark]
6792	SPM	12	23	12	26	The latter part of A9 reads more like a 'response', and should potentially be in Section C. [Government of United States of America]

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7706	SPM	12	23	12	44	the statement starting with "a diversity of responses…" (lines 23 to 25) is valid and it is a good one, but this should be moved to section C, as it doesn't describe an impact, but a response. Delete from here and move to C. This comment applies to other sentences in this part of the text, for example, those referring to building infrastructure [Government of Spain]
6794	SPM	12	25	12	25	Add 6.4 to the reference. [Government of United States of America]
8602	SPM	12	28	12	29	suggest to include this pharase…'attributions of a realistic extention' ….should be inserted in line 29 after the work attributions. [Government of Kiribati]
946	SPM	12	28	12	33	The sub bullet begins with a high confidence statement about the exacerbation of coastal hazards by sea level rise but later in the bullet the significance is diminished by the introduction of non-climatic drivers. These drivers are important and relevant but cannot downplay the more relevant message that should be brought out here about sea level rise. Statement should be reworded. [Government of Jamaica]
3262	SPM	12	28	12	33	This is an extremely long sentence that is difficult to follow. Recommend that the sentences are shortened to convene more clear messages. [Government of Canada]
4958	SPM	12	28	12	33	The formulation regarding IK and LK is a little strange: IK and LK have played an important role in coping with past conditions, their loss does not necessarily lead to increasing exposure and vulnerability to climate change but increases exposure and vulnerability as such. Also, climate-change related changes sounds very odd, and the list of issues does not convey a very clear message. Suggest to rephrase the whole para. [Government of Germany]
6796	SPM	12	28	12	33	Does this statement concern observed or projected exacerbation of hazards? If projected, specify that they "are projected to be…" or "have the potential to" rather than "will…". [Government of United States of America]
6798	SPM	12	28	12	33	Section A9.1 (observed change) includes "loss of indigenous knowledge" in the list of drivers that "have played a very important role in increasing the vulnerability and exposure" of coasts with "high confidence" and it refers the reader to 4.3.3. This key message is not in Chapter 4's key messages and no evidence is provided for including the loss of IK along with subsidence, human development, and habitat degradation for which "high confidence" is supported in the underlying chapter. No case study or data are provided to support the inclusion of loss of IK as an observed driver of coastal change in Chapter 4. Chapter 4 concludes that loss of IK "may increase long-term vulnerability to SLR" with a confidence level of "medium evidence" referring to future change, not observed change. [Government of United States of America]
8194	SPM	12	28	12	33	Statement not clear; the direct implication due to SLR need to be spelt out for more clarity; [Government of India]
2810	SPM	12	29	12	29	changes in coastal human systems' - does this mean population movement or migration away from vulnerable areas? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4960	SPM	12	29	12	29	"… attribution of changes in coastal human systems…". Should this read "attribution of impacts on human systems in the coastal zone"? [Government of Germany]
3264	SPM	12	30			Isostatic adjustment is another important contributor to local relative sea level rise which is important for adaptation and should be mentioned here. [Government of Canada]
8234	SPM	12	30	12	30	it sounds strange that there is medium confidence on the possibility of providing attribution. [Government of Austria]
7936	SPM	12	30	12	31	The list should include the changes in sediment loading (e.g., from the retention of river sediment in dams). [European Union]
7938	SPM	12	31			Shorten "Indigenous Knowledge and Local Knowledge" to "indigenous and local knowledge" (not capitalised). [European Union]
670	SPM	12	31	12	31	"Indigenous Knowledge and Local Knowledge": Can be simplified using "indigenous and local knowledge" as in the SRCCL. [Government of France]
2812	SPM	12	31	12	31	Does 'Indigenous Knowledge and Local Knowledge' needs to be capitalised? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3266	SPM	12	31	12	31	Local knowledge should not be capitalized here. Indigenous knowledge is attached to a group of people with distinct rights and governance structures while it is not clear who 'local' refers to. This is an ongoing conversation at the UNFCCC. There is no constituency for local communities as there is for Indigenous Peoples. Indigenous Knowledge and local knowledge can not be compared or lumped together because they are very different and distinct. Indigenous knowledge is a knowledge system with its own methods, evaluation processes, ever-expanding knowledge base, etc. [Government of Canada]
6800	SPM	12	31	12	31	Indigenous Knowledge and Local Knowledge: Be consistent with capitalization. Knowledge was not capitalized when IK was mentioned earlier in the report. IK should be defined when it is initially mentioned and Local Knowledge should be defined here. [Government of United States of America]
6802	SPM	12	31	12	31	Even if it were not subject to intergenerational "loss", can indigenous or local knowledge development and transfer keep pace with the current changes? Should this sentence encompass both "loss and applicability"? [Government of United States of America]
7942	SPM	12	35			Explain "hard measures". Are they identical to engineered solutions? [European Union]

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Comment id	Chapter	From page	From line	To page	To line	Comment
2814	SPM	12	35	12	35	It is unclear what is meant by 'predictable levels of safety' in terms of hard measures of coastal protection. Should this be 'socially tolerable'? And over what timescale does this refer to in terms of coastal projection vs projected future SLR? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4962	SPM	12	35	12	36	How can the safety level be predictable through tough coastal protection measures? Predictability depends not only on the knowledge of how much SLR a coastal protection structure would withstand, but also on the SLR itself. The latter is not predictable, and therefore the statement that "hard measures provide predictable levels of safety" is misleading - please change the wording, also in Figure SPM.5.c. [Government of Germany]
6804	SPM	12	35	12	36	"Hard measures" should be defined, or alternate language used. Is this referring to built infrastructure? [Government of United States of America]
7940	SPM	12	35	12	36	It is doubtful whether "hard measures" would provide "predictable levels of safety". These measures may have well-specified operational parameters (e.g., protection against a certain level of storm surge), but they do not increase our power to predict events, which are likely to become more severe and more uncertain. Therefore, the level of "safety" (protection from harm) remains largely unpredictable (even if it may have been reduced). By the same token, alternative measures also offer "predictable" levels of safety, just the margin of error in the prediction may be larger. [European Union]
3706	SPM	12	35	12	37	Can widespread be defined or numbers provided? Can predictable levels of safety be defined and metrics be provided? [Government of Ireland]
810	SPM	12	35	12	43	This paragraph should be rewritten in a more balanced way. -> "Coastal protection through hard measures [...]": It should be stressed that the hard measures, in the form of dikes and seawalls, often have very negative effect for the ecosystem and the population we want to protect. Even worse, they can increase the vulnerability to climate change by accelerating erosion and increasing the power of the waves. Finally, these "wall" of defense, hinding the ocean, contribute to giving to people the misleading feeling that they are safe and justify the continuation of urbanisation. -> "Ecosystem-based [...]": This sentence should highlight also their positive co-benefits, it is a bit negative here compared to message C3.1. -> "retreat" is not possible everywhere (SDIS for example) [Government of France]
3268	SPM	12	35	12	44	none of the confidence qualifiers in this paragraph are needed (and indeed should be removed). All sentences are factual statements, not judgements or assessments. [Government of Canada]
3708	SPM	12	35	12	44	Can examples of response actions be given including for community based appraoches? [Government of Ireland]
4192	SPM	12	35	12	44	It could be helpful to define what is meant by 'community-based approaches' here, or provide an example. This point (A9.2) contains material that also fits within sections C2-C4 on Options and Enablers. Please consider moving. [Government of Norway]
8522	SPM	12	35	12	44	A9.2: "Retreat is also observed, but is generally restricted to small human communities": what is it consider small human communities? The term is vague and gives room for many interpetrations on the community size. [Government of Kiribati]
6806	SPM	12	36	12	38	It feels like an oversimplification to say "little is known" about the cost and effectiveness of ecosystem-based and hybrid approaches to coastal protection. There are a number of studies on green infrastructure projects around the world, including on return on investment. See for example: https://coastalresilience.org/project/coastal-defense/ and https://www.climatelinks.org/blog/new-usaid-ecosystem-based-adaptation-evidence-summary-and-case-study-series [Government of United States of America]
7944	SPM	12	37	12	37	proposal to replace 'liittle is known' by comparatively little is published. Rationale: while knowledge gaps exists, I find it is not correct to say 'little is known'. The difficulty being that many benefits of eocsystem-based approaches are not (eg benefits to human health) and often cannot (intrinsic value, cultural value) be costed in monetary value. Often knowledge exists and these approaches have been implemented already, in spite of not having been published in scientific papers. In addition there are several different terms for very similar and sometimes identical measures. Those terms includes eccosystem-based approaches, nature-based solutions, green infrastructure, ecological infrastructure, working with nature ... [European Union]
6808	SPM	12	38	12	38	Coastal scientists and managers do not generally use the singular word "advance" to describe coastal land building. They do refer to coastal shoreline transgression and regression and coastal retreat and advance. Authors either need to insert the word "coastal" before "advance" or use more layman-friendly terms such as "coastal land building and shoreline stabilization". [Government of United States of America]
7946	SPM	12	38	12	38	The inclusion of 'advance' in this paragraph implies that it is a technique for adapting to sea level rise. Surely it is the opposite: i.e. it is a technique for adapting to population density and land demand, despite the fact it exacerbates risks associated with sea level rise. [European Union]
4964	SPM	12	38	12	40	The sentence "Advance, which refers to the creation of new land..." seems to be out of context. Advance measures would increase risk by putting more people and assets into harms way, so how would advance constitute a response to rising sea levels? Suggest to delete the reference to advance here, and in B9. [Government of Germany]

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3270	SPM	12	38	12	43	It is unclear how “advance” and “retreat” are response strategies to climate related ocean changes, especially sea level rise. This should be the context for discussing these adaptations. How do these response measures influence vulnerability and exposure to sea level rise and other coastal changes? [Government of Canada]
6810	SPM	12	40	12	40	"Retreat, which refers to..."-- include a brief description here as was done for advance. [Government of United States of America]
6812	SPM	12	40	12	40	Authors mix the concepts of physical coastal shoreline erosion with the "retreat" of coastal communities. People don't generally retreat from low-lying coasts to create "coastal wetland habitat". They retreat to protect people and infrastructure, sometimes using wetlands as a buffer against marine forces (storm surge and waves). [Government of United States of America]
4350	SPM	12	40	12	41	Need precison on what are small human communities. Are island communities included? [Government of Monaco]
4352	SPM	12	40	12	41	"Retreat" is one response to sea level rise, but it is not intuitive for non-scientific readers. Morevoer, it is not define in Annex I. Should be underline that retreat isn't a solution for SIDS countries where no retreat is possible because of the high risk and small surface. [Government of Monaco]
8524	SPM	12	41	12	42	A9.2: "Community based approaches are increasingly used to adapt to sea level rise, especially in developing countries and to adapt to changing marine environments in the Arctic (high confidence).": there are two totally different scenarios here as many developing countries will suffer a lot more of stress than other areas, therefore information should be placed accordingly [Government of Kiribati]
1080	SPM	12	43	12	43	Suggest incorporating further research. Loss of mangroves has been up to 100% in some areas - in Australia's Gulf of Carpentaria, in 2015, a length of over 1000 km of shoreline were affected, with more than 7400 hectares (6% of total area) lost, with losses from 10% up to 100% in some areas (National Environmental Science Program Northern Hub project - Assessing mangrove dieback in the Gulf. See https://www.researchgate.net/publication/314967065_Large-scale_dieback_of_mangroves_in_Australia,) [Government of Australia]
5128	SPM	12	47			General Comment: Under B1 and/or B3 there should be a para describing the expected (in)stability of the polar ice sheets and its impacts on future Sea Level Changes. The processes of surface melting, Marine Ice Sheet Instability (MISI) and Marine Ice Cliff Instability (MICI) should be considered. (p. 3-55/58), and the risk of irreversible abrupt change from a collapse of parts of the AP, WAIS, EAIS and Greenland should be discussed. The possibility of crossing a threshold already at 1.5C should be highlighted, in line with the findings of SR1.5, and key findings integrated into the headlines message. See also our comment on "Treatment of mean sea level rise, extreme sea levels and adaptation across sections B and C" (whole SPM), where we suggest to split B3 into two parts (GMSL and ESL-events), making room in the GMSL for discussion of the contribution from WAIS disintegration. [Government of Germany]
4236	SPM	12	47	12	47	Please consider explaining, probably in a box, how the scenrios in this report RCP2.6/RCP8.5 are related to the scenarios used in the 1.5C report. The RCPs are mentioned a lot in the text and the reader should know what each scenario implies. You could look to footnote 7 at page 13 for text about explaining the RCPs. Ideally, we feel that it would be beneficial if a third scenario based on 1.5C warming was included in this report. We support that the 1.5C scenario is used a few times in the SPM. At the same time the 2.6 and 8.5 is used in the graphics. It may be beneficial for the reader if the choice of these RCPs is also explained in such a box. Alternatively, we suggest that you explain why 1.5C is not adressed. [Government of Norway]
2820	SPM	12	47	21	41	It is not always clear throughout section B which impacts will occur regardless of emissions scenario, or whether they are associated with a specific one. For example, in B1.1, 'glaciers are projected to lose more than 80% of their current mass by 2100' comes just after a discussion about two different RCPs, and its not clear which this corresponds to. For those impacts that are committed and will arise regardless of scenario, this should be stated. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7948	SPM	12	51			Is "degradation" the right word? Is "thaw" not enough to describe? "Degradation" (of land) is generally understood to mean (or involve) a reduction in productivity. The thawing of permafrost is often accompanied by an increase of productivity and expansion of vegetation (c.f. B1.3). Whilst the process is undesirable and deleterious in many ways, describing it as "degradation" seems incoherent with other contexts. [European Union]
4242	SPM	12	51	12	51	Consider explaining briefly why the mentioned changes are projected to continue in the near term [Government of Norway]
4574	SPM	12	51	12	51	What remains if ice sheets and glaciers are excluded ? Is it excluded to keep the high confidence (snow and permafrost) ? Ice sheets should be included on p 12 line 51 [Government of Belgium]
3272	SPM	12	51	12	52	"thaw and degradation" - essentially means the same thing - say one or the other. Recommended alternative is to use the phrase: "warming and thawing of permafrost" [Government of Canada]
8668	SPM	12	51	12	53	Adjust text to: "Widespread retreat of glaciers, decrease in snow cover duration, and thaw and degradation of permafrost will continue to affect river runoff, both in volume as well temperal distribution over the year, in the near-term. [Government of Netherlands]

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3274	SPM	12	51	13	4	If this is meant to be a summary statement with further details provided in subsequent paragraphs, why is "river runoff the only impact of cryospheric change mentioned. The statement should be more inclusive given that the subsequent paragraphs include other impacts such as carbon release, landscape change and avalanches. It is suggested that you provide a summary of the projected changes in cryospheric components and then indicate that these will continue to have impacts on the physical environment. [Government of Canada]
3472	SPM	12	51	13	4	The underlying report does not treat sea ice under "Ocean", but rather as a part of the Cryosphere. The Section B.1 should be made to be about the Cryosphere, not the Terrestrial Cryosphere. This would entail moving B2.1 from page 14 here. This would be more in line with general delineation of the systems, and in line with the underlying report (e.g. Chapter 1 defines sea ice as part of the Cryosphere, 1.2.2. inherently separares between the Ocean and the Cryosphere, as do 1.4.1-1.4.2.) [Government of Sweden]
3710	SPM	12	51	13	4	Define widespead [Government of Ireland]
3712	SPM	12	51	13	4	Projected is enough as these may not be consistant with the past [Government of Ireland]
4240	SPM	12	51	13	4	Consider including ice sheets, and also reflect that the changes are driven by temperature increase [Government of Norway]
5130	SPM	12	51	13	4	We suggest to include a reference to the basis for the statements (text complement in bold); alternatively could this text (bold) placed after p. 12, line 49 and before line 51: B1. Widespread retreat of glaciers, decrease in snow cover duration, and thaw and degradation of permafrost, affecting river runoff, are projected to continue in the near-term (high confidence). The rates and magnitudes of terrestrial cryosphere losses are projected to increase further in the second half of the 21st century in a high greenhouse gas emissions scenario (high confidence). Deep reductions in greenhouse gas emissions in the coming decades are projected to likely reduce further changes in terrestrial cryosphere (excluding ice sheets and glaciers) beyond the near term (high confidence). Scientific basis of these results are projections and assessments of future climate, ocean and cryosphere changes based on coordinated climate model experiments from the Coupled Model Intercomparison Project Phase (CMIP5) forced with Representative Concentration Pathways (RCPs) of future radiative forcing. {2.2, 2.3, Cross-Chapter Box 6 in 4 Chapter 2, 3.3, 3.4, Figures SPM.1, SPM.2} [Government of Germany]
5132	SPM	12	51	13	4	The current text of B1. does not provide a fitting summary for B1.1 to B1.5. Suggestion for new text: "The largest regional contributions to glacier mass reductions are from polar regions. Widespread thaw of permafrost will release carbon into the atmosphere with potential for accelerating climate change. Landslides and floods resulting from decreasing stability of the high-mountain slopes will manifest in new locations." [Government of Germany]
5134	SPM	12	51	13	4	Please revise this para with clear and simple language. For example, terrestrial cryosphere losses -- losses of ice sheets, glaciers and permafrost; or "ice sheets and glaciers will likely continue to contribute even under deep reductions"" instead of "reduce further change ...". [Government of Germany]
6074	SPM	12	51	13	4	Vague paragraph, the magnitude of the impact is not clear nor the level of GHG emissions reduction needed to avoid such impact is not clear either. [Government of Saudi Arabia]
6814	SPM	12	51	13	4	The impacts on humans and society needs to be the first finding, rather than describing the phenomena that will be leading to said impacts. The SPM is for policymakers, and the impacts on humans needs to be front and center. Even in text here, while saying river runoff will be affected, there is no mention of the significance for humanity -- which will be substantial given the reductions in runoff that wil be occurring in the Andes and Himalayas. [Government of United States of America]
2818	SPM	12	51	15	53	Section B should explicitly mention the key message that some impacts are already inevitable and will occur regardless of future emissions pathway. This includes highlighting that some of the impacts of climate change on the oceans and cryosphere, such as ice sheet and glacier loss, take centuries to millenia to fully manifest, and will therefore continue well beyond 2100. This could use text such as "Long response times mean that the deep ocean and the large ice-sheets tend to lag behind in their response to the rapidly changing climate at Earth's surface, and that they will continue to change even after radiative forcing stabilises" (chapter 1 of undelying report) and "Sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (high confidence)." [Government of United Kingdom (of Great Britain and Northern Ireland)]
6010	SPM	12	51	15	53	The way of describing RCP2.5 and RCP8.5 scenarios needs to be consistent within SPM B. For example, the RCP2.5 scenario is mentioned before the RCP8.5 scenario in sections B1 and B3 while the case in section B2 is opposite. [Government of Republic of Korea]

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Comment id	Chapter	From page	From line	To page	To line	Comment
2822	SPM	12	51	21	42	Throughout section B, there is a focus on projections from RCP2.6 and RCP8.5. It is not clear to a policymaker whether you can associate these RCPs with a given temperature. It is also not clear for some of the statements and ranges in the results, which RCP the findings correspond to. It would be more useful to not rely on the specific scenarios, but instead use them more generally to illustrate trends between low and high emission scenarios. (e.g. Instead of "In RCP2.6, impact A will reach level X; in RCP8.5 impact B will reach level Y" but "In lower emission scenarios, impact A will happen, but could potentially reach impact B in higher emission scenarios") [Government of United Kingdom (of Great Britain and Northern Ireland)]
1082	SPM	12	52	12	52	Suggest defining "near-term". [Government of Australia]
8236	SPM	12	52	12	52	sounds as effects on river runoff would be the only ones from glaciers, snow and permafrost changes!? [Government of Austria]
5136	SPM	12	52	13	1	Cryosphere losses are going to continue. This statement is unnecessarily limited to the 21st century. Revise to read „in the second half of the 21st and subsequent centuries.“ to stress long term change. [Government of Germany]
4576	SPM	13	0			footnote 7: line 5 to 7 of this footnote contains highly relevant information for policymakers relating to the 'two in three chance of limiting warming by the end of the century'. The footnote refers to figure SPM1 but I do not seem to find this specific information in the figure nor in the text? [Government of Belgium]
4360	SPM	13	0	13		Fully labelling RCP as Representative Concentration Pathways, and then the report should simply refer to the acronym and not repeat the full phrase. [Government of Monaco]
6082	SPM	13	0	13		Mitgation policies are not enough, adaptation efforts are needed as well. [Government of Saudi Arabia]
7710	SPM	13	1	13	1	the sentence mentions "a high greenhouse gas emissions scenario". This reference should be more specific or deleted. [Government of Spain]
1086	SPM	13	1	13	3	Suggest re-wording to simplify message: the sentence "Deep reductions..." does not read well. [Government of Australia]
6816	SPM	13	1	13	3	Last sentence of the B1 summary box reads like a 'response' instead of a 'projected change'. Consider moving to Section C. [Government of United States of America]
8508	SPM	13	1	13	3	Regardless of low or high emissions, we are locked in for changes for the atoll islands in the Pacific Islands. The statement as it is now, needs also to include low emissions scenario projections [Government of Kiribati]
3276	SPM	13	1	13	4	Only glaciers and ice sheets are excluded from the statement that reducing emissions in the coming decades can reduce further physical changes in the cryosphere. Para B1.3 below on permafrost seems to indicate a large potential for ongoing thaw and release of carbon over the 21st century under both low and high emission scenarios. Please clarify whether or not permafrost thaw stabilizes under RCP2.6 after mid-century. [Government of Canada]
5444	SPM	13	1	13	4	This statement is not very clear. Suggestion to clearly state that "Deep reductions in greenhouse gas emissions in the coming decades" will reduce risks and impacts up and beyond 2100. [Government of Saint Kitts and Nevis]
7950	SPM	13	1	13	4	B1 - This sentence seems to assume there will be deep reductions in GHG. The formula is optimistic, perhaps a more neutral formula would say that “If deep reductions are not achieved, changes (reduction?) in terrestrial cryosphere etc...”. [European Union]
1088	SPM	13	2	13	2	Suggest 'likely' be italicised. [Government of Australia]
2824	SPM	13	2	13	2	Suggested change: 'cause further declines in terrestrial...' ? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3474	SPM	13	2	13	2	"likely" would seem to be an unexpected qualifier for the fact that deep reductions in GHG emissions reduce impacts compared to high emissions. Could this be checked and reformulated as appropriate. Also, please add the "baseline" against which "reductions" are measured. Alternatively, deep GHG reductions may be said to lead to "avoiding" changes/risks for change... [Government of Sweden]
7952	SPM	13	3			it could be relevant to indicate the period considered under "near term". Is it 2031-2050? [European Union]
674	SPM	13	3	13	3	Please consider introducing "(2031-2050)" after "near term" as it is done in B1.2 l.17 [Government of France]
2830	SPM	13	5	13	13	Is there data on glacier mass loss at 1.5°C? And similarly, is anything known (even theoretically) about the effect of an overshoot on glacier mass loss? If so, could this be included? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4056	SPM	13	5	13	5	Consider including a statement explaining that for all changes, the tracectories will follow similar pattern in near term, and splitting only after mid-century depending on greenhouse gas emissions -- potential text can be found in 3.2.3.1. [Government of Norway]
4058	SPM	13	5	13	5	Consider including a statement on temperature increase somewhere in B1. [Government of Norway]
3476	SPM	13	6	13	14	Please clarify that this does not include ice sheets. This might be further clarified if a bullet about ice sheets were to follow here (cf. B3.1, B3.4). [Government of Sweden]
6818	SPM	13	6	13	14	How is it that the consequences in the Andes and Himalayas are not even mentioned? These are areas where the changes that do occur will have the most effect on essential water resources for society. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7464	SPM	13	6	13	14	Projected glacier mass reductions are described for RCP2.6 and RCP8.5. It is desirable that those reductions are described also for other RCPs. [Government of Japan]
7956	SPM	13	6	13	14	B1.1 Does the sea level rise in mm refer to cumulative rise by 2100? It would be useful to equate this to the units shown in Figure SPM1. It is also confusing to use the metric 'sea level rise equivalent' outside of sections dedicated to sea level rise. Perhaps it is better to restrict statements on glacier contribution to sea level rise to the sea level rise sections. [European Union]
2846	SPM	13	6	13	15	Sea-level rise icon should also be included as mentioned here? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7708	SPM	13	6	13	31	we reiterate our comment of using tables for numbers uncertainty ranges, units, periods of time, intervals of GC,… Text should be easier to read, there are paragraphs that are hard to read even for scientists. Policy makers won't look at them. [Government of Spain]
1432	SPM	13	6	13	6	Add polar icon. Arctic glaciers and peripheral GrIS glaciers are important. [Government of Denmark]
1208	SPM	13	6	13	7	The Executive Summary and the body text of Chapter 2 of the underlying report are inconsistent in formulating the same finding, while the SPM cites the latter. It is suggested to check this for a general revision specifically as follows: The Executive Summary of Chapter 2 on page 4 states that “Projected glacier mass reductions between 2015 and 2100 are likely 22–44% for RCP2.6 and 37–57% for RCP8.5”. Cross-Chapter Box 6 of Chapter 2 on page 18 states that “Results indicate global glacier mass losses by 2100 relative to 2015 of 18% [likely range 11 to 25%] (mean of all projections with range referring to ± one standard deviation) for scenario RCP2.6 and 36% [likely range 26 to 47%] for RCP8.5, but relative mass reductions vary greatly between regions”. The SPM states that “Projected glacier mass reductions between 2015 and 2100 range from 18±7% for a low emissions scenario (RCP2.6) to 36±11% for a high emissions scenario (RCP8.5)”. [Government of China]
5138	SPM	13	6	13	7	The estimated values for the global mean temperature rise by 2100 implied by the implementation of the NDCs range from 2.7°C to 3.5°C compared to preindustrial levels. This is lower than the projected temperature rise under RCP8.5 which is 3.2°C to 4.4°C. It would have been very useful to include also information on RCP4.5 or RCP6.0 that are more consistent with the NDC-implied warming. If this is not possible, please extend the explanation in footnote 7 on the choice and relevance of RCP8.5. [Government of Germany]
7462	SPM	13	6	13	7	Please check “Projected glacier mass reductions between 2015 and 2100 range from 18 ± 7% for a low emissions scenario (RCP2.67) to 36 ± 11% for a high emissions scenario (RCP8.5) ” (“Projected glacier mass reductions between 2015 and 2100 are likely 22 – 44% for RCP2.6 and 37 – 57% for RCP8.5” in page 2 – 4 of Chapter 2) [Government of Japan]
4070	SPM	13	6	13	9	Please check that there is consistency between this text and figure SPM.1. Intentional differences should preferably be explained. [Government of Norway]
4072	SPM	13	6	13	9	Is ice sheets included in glacier mass here? If not, include ice sheets. If yes, consider writing ice sheets and glacier mass loss [Government of Norway]
7954	SPM	13	6	13	9	It is very important for the policy relevance of the figures on sea level rise to present them in a readable and consistent way throughout the SPM. In the present paragraph the range of se level rise associated to glacier mass reduction only ranges from 99 mm to 200 mm (from 2015 level) while the range indicated in figure SPM 1 graph (d) is quite different (roughly from 30 to 90 mm from 1986-2005 level) while that graph refers to projected GMSL hence adding up the glacier mass reduction to the thermal expansion of water. If the data are correctly displayed further explanations would be needed to provide a clear policy-relevant message on GMSL and regarding the respective contribution of glacier mass reduction and of the thermal expansion [European Union]
6820	SPM	13	7	13	7	Regarding footnote 7, second sentence, "Current greenhouse gas emissions continue to grow at a rate consistent with a high emission future without effective climate change mitigation policies (referred to as RCP8.5)." This text should be included in the Introduction, perhaps at the end of the Startup Box. The term 'RCP' first appears on page SPM-4, line 4. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6822	SPM	13	7	13	7	Using RCP8.5 and 2.6 as consistent framing throughout this SPM has large implications for both short- and long-term projections. Given that the reader is provided important context about RCP8.5 (i.e., that "current greenhouse gas emissions conitinue to grow at a rate consistent with a high emission future..."), the same context should be given for RCP2.6 -- that is, to what extent does the emissions path in RCP2.6 already deviate from recent and current emissions? This is important to convey especially where near-term (i.e., between now and the year 2040 or so) risks and impacts are concerned. Furthermore, given how important this framing is, strongly recommend that this information not be sidelined to a footnote, but rather placed up front in a prominent text box. [Government of United States of America]
8314	SPM	13	7	13	7	This comment relates to footnote 7. The RCP scenarios are already mentioned in the caption to Figure SPM 1, but they are not explained until 9 pages later. It would be helpful if this explanatory information were to be provided earlier in the SPM. [Government of New Zealand]
1434	SPM	13	7	13	8	Move SLR contribution section to B3.1 [Government of Denmark]
4578	SPM	13	7	13	8	"corresponding to a sea level contribution" : could it be phrased 'corresponding to a contribution in sea level rise...'? [Government of Belgium]
676	SPM	13	9	13	10	Please add the scenario under which is made this projection. Is it RCP8.5? [Government of France]
8440	SPM	13	9	13	10	We salute the mention that, in "regions with relatively little ice cover (e.g. ... low latitudes, ...)", which includes the tropical Andes of Peru, "glaciers are projected to lose more than 80% of their current mass by 2100 (medium confidence)". This is a critical issue for Peru. [Government of Peru]
1354	SPM	13	9	13	11	Please specify to which scenario this statement is referring. [Government of Luxembourg]
1480	SPM	13	9	13	11	This statement probably refers to RCP8.5 as in the following sentence, but this should be made clearer. [Government of Italy]
6824	SPM	13	9	13	11	Is the reason for more ice loss in these areas that there is less ice cover, or that temperatures are higher and closer to 0°C? The underlying chapter does not provide an explanation, but it is important to contextualize and explain the signficance of this striking statement. Perhaps the statement from the underlying chapter (page 2-18) could be brought forward: "While these glaciers' contribution to sea level is negligible their large relative mass losses have implications for streamflow." [Government of United States of America]
8666	SPM	13	9	13	11	Is the mass loss of more than 80% by 2100 valid for both RCP2.6 as well as RCP8.5? If not, adjust the text and be more specific for which RCP. [Government of Netherlands]
4354	SPM	13	9	13	9	Replace "little ice cover" with "small glaciers (e.g...." [Government of Monaco]
1210	SPM	13	10	13	10	The sentence in Chapter 2 on page 4 of the underlying report - "glaciers will lose more than 80% of their current mass by 2100 under RCP 8.5 (medium confidence)" - is suggested that "RCP 8.5" be added after "2100". At the same time, in order to increase the textual accuracy, it is suggested that "current mass" be changed to "ice value". [Government of China]
2826	SPM	13	10	13	10	projected to lose more than 80% of their current mass by 2100' Is this regardless of scenario? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8238	SPM	13	10	13	10	in which scenario? Or is this independend from RCPs? [Government of Austria]
3278	SPM	13	11		12	For historical changes, glaciers in Antarctica and Greenland are treated separately from those in the rest of the world, whereas here they are treated together. Recommend a consistent approach. [Government of Canada]
8240	SPM	13	11	13	11	contributors to what? [Government of Austria]
4356	SPM	13	11	13	12	add: southern Andes [Government of Monaco]
2844	SPM	13	11	13	14	This phrasing is unclear -does this mean regional contributors to projected global glacier mass reductions over this century? Perhaps it means contributions to sea level rise, based on the second half of this sentence. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2850	SPM	13	11	13	14	Are these regions also expected to be the largest contributors to sea level rise under other, lower, warming scenarios as well? Why the specific focus on RCP8.5 here? Are the regional contributions different in different scenarios? If yes, this would be useful information to present. If no, then it seems redundant to mention RCP8.5 here. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7958	SPM	13	11	13	14	Text clarification: Insert "to glacier mass reduction" after contributors to read: "The largest regional contributors to glacier mass reduction are...". [European Union]
2828	SPM	13	12	13	12	..which, when combined, make up..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
7572	SPM	13	12	13	12	Svalbard glaciers are not mentioned, but they are important contributors to sea-level. Are they a part of Scandinavian glaciers? [Government of Finland]
2834	SPM	13	16	13	16	'snow cover duration' meaning number of days with snow cover? This change of wording may be more tangible for a policymaker. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8316	SPM	13	16	13	16	Insert "a" before "further" thus "...decrease by a further 5-10%..." [Government of New Zealand]

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5140	SPM	13	16	13	17	Pls consider the original text related to Arctic snow-cover (p. 3-63): Under RCP4.5, Arctic snow cover duration stabilizes at 5-10% reduction (by end of century compared to a 1986-2005 reference period); under RCP8.5 snow cover duration declines reach -15 to -25% (high confidence). [Government of Germany]
1212	SPM	13	16	13	19	The estimates of snow cover duration under RCP 2.6 and RCP 8.5 are given in the SPM. However, the estimates in the underlying report are made under RCP 4.5 and RCP 8.5. It is suggested that the RCP scenarios be checked and aligned. [Government of China]
6826	SPM	13	16	13	22	It is not clear to what reference period these percentages are compared. In that warming (at least in all the scenario studies) is with respect to preindustrial, what should be given here are reductions with respect to preindustrial, not to the significantly reduced amounts present today, which really minimizes the extent of change that has occurred. By 2100, under RCP8.5, vast areas that used to have at least some preindustrial snow cover will have virtually none and the Arctic region will be nothing like it was, and even as it is now. B1.2 as currently formulated makes it seem as if the changes will be virtually minimal, and this is very misleading, especially as the RCP8.5 case has continued warming after 2100. [Government of United States of America]
7466	SPM	13	16	13	23	Projected snow cover changes are described for RCP2.6 and RCP8.5. It is desirable that those changes are described also for other RCPs. [Government of Japan]
1214	SPM	13	19	13	20	This sentence states that "Projected decreases in low elevation mean winter snow depth in mountain areas," while the Executive Summary of Chapter 2 on page 4 of the underlying report states that "Compared to 1986-2005, low elevation snow depth will likely decrease by 10-40% for 2031-2050." The two inconsistent statements are suggested to be checked and modified. [Government of China]
6828	SPM	13	21	13	23	Switch the ordering of RCPs in this sentence for the sake of consistency. [Government of United States of America]
6830	SPM	13	21	13	23	"projected decrease" in what? Snow depth or duration? Clarify. [Government of United States of America]
7960	SPM	13	25			Is "degradation" the right word? Is "thaw of permafrost" not enough to describe the phenomenon? "Degradation" (of land) is generally understood to mean (or involve) a reduction in productivity. The thawing of permafrost is associated here with an increase of productivity and expansion of vegetation. Whilst the process of thawing is undesirable and deleterious in many ways, describing it as "degradation" seems incoherent with other contexts. [European Union]
3282	SPM	13	25	13	25	See earlier comment - just use either "thaw" or "degradation" (redundant to use both) or say "warming and thawing" [Government of Canada]
5142	SPM	13	25	13	26	It is confusing to certify "very high confidence" for thaw and degradation of permafrost, while the given ranges of 2-66% and 30-99% are really large. [Government of Germany]
3280	SPM	13	25	13	28	The ranges given for decreases in the extent of near surface permafrost are extremely large (2-66% under RCP2.6 and 30-99% under RCP8.5), as is the range of potential loss of permafrost carbon (10s to 100s of billions of tons). To be useful to policymakers, the reasons for these very large ranges should be explained. Also, it is unclear if the projected loss of 10s to 100s of GtC applies to RCP8.5 scenario only or if the low end of this range applies to projections based on RCp2.6. Most of the studies cited in section 3.4.3 are based on RCP8.5 results. Given the small remaining anthropogenic carbon budget for limiting GW to 1.5-2C, understanding the size of this potential carbon feedback in low emission scenarios, is important. [Government of Canada]
6076	SPM	13	25	13	29	While there are other scientific source suggested that Permafrost regions may contains only 1500 Gigatonnes of carbons in the form of frozen organic matter, nearly as twice as much as is currently in the atmosphere. (Alfred Wegener Institute / Lars Grübner) [Government of Saudi Arabia]
2848	SPM	13	25	13	31	Should the icon also include montain areas? Permafrost also exists in the mountain cryosphere (as demonstrated in B1.4) [Government of United Kingdom (of Great Britain and Northern Ireland)]
2852	SPM	13	25	13	31	It would be useful to explicitly state here that these feedbacks are likely to constrain the size of the available carbon budget to meet our Paris Agreement targets. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5144	SPM	13	25	13	31	pls. add: The permafrost soil carbon pool is climate sensitive and an order of magnitude larger than carbon stored in plant biomass (very high confidence) (p. 3-65). Widespread thaw.... . ..., Figure SPM.1}. There is high confidence that climate scenarios that involve mitigation will help to dampen the response of carbon emissions from the Arctic and boreal regions. (p.3-66) [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5146	SPM	13	25	13	31	Section B1.3 should be rewritten considering the following issues: i) the ranges given for permafrost area are very large, reflecting mostly issues of different definitions and sensitivities in underlying models. This conflicts with the verb "will". If evidence is so uncertain, it may help to spell this out explicitly: sth along the lines of "Projections show large ranges due to different definitions and sensitivities in underlying models. For a low emission scenario, expected near surface PM area may stabilize or be reduced by up to two-thirds; for high emission scenarios, estimates range from a 30% loss to complete elimination of all surface PM by 2100"; it may also be helpful to try and further constrain those estimates: A recent meta-study reported in Chapter 3 (McGuire 2018 PNAS) provides more distinct values (Cf 3.4.2.2). Also, the likely instead of the full range of model results could be given, reducing the influence of outliers. ii) the "10s to 100s of Gt of C" statement is very unclear. Logically, it should come straight after the first sentence, as thaw and degradation lead to the emissions, not necessarily the shrinking area of near-surface permafrost. Also, some sort of qualification (what range pertains to which emission scenario) would be extremely helpful. And would it not make sense to call this feedback mechanism a feedback instead of saying "with the potential to accelerate climate change"? iii) it is unclear why the authors highlight the potential of plant growth and soil replenishment to compensate for permafrost carbon losses if the amount of expected C-loss is not known, and there is only medium evidence with low agreement on the finding. Also, plant regrowth is assessed as a part of the land carbon cycle (Northern Greening) and accounted for already in climate models, while permafrost degradation is not, at least not appropriately. If the authors wish to highlight processes that go beyond what is currently captured in climate/dynamic vegetation models, they should make that explicit. Else this reads as if the authors were trying to downplay the effect of permafrost degradation by highlighting increased vegetation in the Tundra, which is certainly not their intention. iv) the plant regrowth - permafrost carbon loss comparison misses the point that some permafrost degradation processes may be irreversible and potentially release very large quantities of GHGs over short periods of time, whereas soil replenishment and plant regrowth are slow and steady processes that go towards saturation after some time, and may be reversed, e.g. by increased Tundra wildfires. Therefore this comparison and in particular the term "compensation" seems ill-advised. v) it would make sense to strengthen the finding that future C release from permafrost, while uncertain, depends on future warming and can be prevented by mitigation. e.g. McGuire et al conclude "that effective mitigation efforts during the remainder of this century could attenuate the negative consequences of the permafrost carbon–climate feedback." We would very much encourage the authors to include a similar statement here and/or in section C. [Government of Germany]
7468	SPM	13	25	13	31	Projected thaw of permafrost is described for RCP2.6 and RCP8.5. It is desirable that those changes are described also for other RCPs. [Government of Japan]
8210	SPM	13	25	13	31	Can some realistic estimate of projected methane emission from permafrost be given, since it is very important in climate change feedback process. The range given here is too broad and the differences under various projection scenarios are not clear. [Government of India]
1090	SPM	13	26			Suggest including further context. It may be difficult for the reader to interpret a range like 2 to 66%. Given that this range is for RCP2.6, how would a policy/decision-maker decide on actions to keep it closer to 2% rather than 66%? [Government of Australia]
2836	SPM	13	26	13	26	Would be useful to know the medians for the permafrost area decrease ranges. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3284	SPM	13	26	13	26	An arbitrary term like "near-surface permafrost" should not be used without defining the depth considered which I believe is 3m but not sure defined in Ch. 3. You also don't want to imply here that permafrost has completely disappeared as it may still be present at greater depth even if it has thawed in upper 3 m (if that is depth used for near-surface). Note this depth is chosen by the ecology community so there is some bias here as the fate of deeper permafrost is of interest to engineers and hydrogeologists. Suggested rewording: By 2100, the areal extent of near-surface (within # m) permafrost will decrease by 2-66% for RCP2.6 and 30-99% for RCP85. [Government of Canada]
3478	SPM	13	26	13	26	What do these ranges refer to (all studies? Likely range?)? [Government of Sweden]
6832	SPM	13	26	13	26	"near-surface permafrost" -- Include depths or definition. [Government of United States of America]
6834	SPM	13	26	13	26	Having 2% as the lower limit seems far too low given how much thawing and degradation are currently underway. And, on the point generally, what are the percentages with respect to -- current amounts? To be consistent, the reference period needs to be preindustrial. So what percentage has been affected to date, and how much total area will be affected by 2100? [Government of United States of America]
6836	SPM	13	26	13	27	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
3286	SPM	13	27			Projected carbon emissions from permafrost are of high interest and considerable importance. The range of projections here is so vague (expected to release 10s to 100s of billions of tons of permafrost carbon), as to not be very useful to policymakers and other readers. Recommend replacing with an assessed likely range under high and low emissions scenarios by 2100. [Government of Canada]

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4358	SPM	13	27	13	27	Very vast figures. Can be deleted if more detailed in SR Land Use. [Government of Monaco]
5148	SPM	13	27	13	27	Pls. insert: …RCP8.5 (medium confidence) (p.3-64) [Government of Germany]
8610	SPM	13	27	13	27	Does this take the different GWP of methane into account? [Government of Netherlands]
8318	SPM	13	27	13	28	Either move "to the atmosphere" to before "10s to 100s" such that the beginning of the sentence reads: "…This is expected to release to the atmosphere 10s to 100s of billions of…." or delete "to the atmosphere" altogether as it may not be necessary to say this. [Government of New Zealand]
3288	SPM	13	27	13	29	You should say up front that these values for carbon release are for high emission scenarios. Also the terminology used in Ch. 3 is "potential release" so shouldn't this be used instead of "expected release"? Chapter 3 also indicates that there is medium confidence with respect to the amount of carbon to be released but high confidence that with mitigation scenario the carbon loss will be dampened. The statement in SPM implies medium confidence for both and probably should be revised. [Government of Canada]
3290	SPM	13	27	13	29	It is not clear what the medium confidence in this sentence applies to. Does it apply to the projection of 10s to 100s of billions of tons of carbon potentially released from permafrost thaw or to the statement that emissions are expected to be smaller for lower emission scenarios? [Government of Canada]
6838	SPM	13	27	13	29	The A1.4 statement "… although evidence is divergent whether permafrost warming is currently causing the release of additional greenhouse gases to the atmosphere" conflicts with this B1.3 sentence. Consider expanding A1.4 to explain divergence in science. [Government of United States of America]
7962	SPM	13	28	13	28	It would benefit to quantify the "potential to accelerate climate change". [European Union]
2832	SPM	13	28	13	29	Do we know how much smaller the size of the feedback is going to be? Similarly, can this be translated into additional °C of warming if possible? [Government of United Kingdom (of Great Britain and Northern Ireland)]
1356	SPM	13	28	13	31	Please specify what "smaller" means in this context. In particular, provide numbers by how much the release is reduced between 1.5°C and 2°C scenarios. [Government of Luxembourg]
2838	SPM	13	29	13	29	Is medium confidence correct for this statement? Isn't there confidence of greater permafrost carbon release at a higher temp rise? Or is this is down to some models suggesting regional cooling under some scenarios? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7964	SPM	13	29	13	30	B1.3 The statement that increased plant growth and soil replenishment may 'compensate' for hundreds of GtC of permafrost carbon losses is highly problematic. Firstly, because it conveys a sense of 'balance' or 'cancelling out' which is surely not warranted from the scientific evidence. And secondly because the Technical Summary appears to contradict the SPM on this matter (TS - "There is medium evidence but with low agreement whether the level and timing of increased plant growth and replenishment of soil will compensate these permafrost carbon losses.") [European Union]
678	SPM	13	29	13	31	Please consider rephrasing this sentence as "may compensate" does not sound consistent with "high confidence" [Government of France]
1216	SPM	13	29	13	31	In this sentence “The level and timing of increased plant growth and replenishment of soil may compensate, in part, for permafrost carbon losses (high confidence)”, “high confidence” is assigned. However, the Executive Summary of Chapter 3 on page 6 of the underlying report states that “There is medium evidence but with low agreement whether the level and timing of increased plant growth and replenishment of soil will compensate these permafrost carbon losses”. “medium evidence” and “low agreement” are suggested to be checked and aligned. [Government of China]
5150	SPM	13	29	13	31	The sentence is semantically odd: The detail about level and timing is mentioned for the newly introduced effect of plant growth and replenishment of soils, but rather the effect on the main phenomenon of the paragraph (i.e. permafrost carbon loss) should be highlighted. We suspect, what was meant was: "Increased plant growth and replenishment of soil may in part compensate for permafrost carbon losses." (and thus this affects the level and timing of the carbon losses)? Please clarify. [Government of Germany]
6840	SPM	13	30	13	30	B1.3 needs more context. The hedging "… may compensate, in part …" is extremely vague. Is this the same order of magnitude as the problem? This seems like an enormous problem. Is it? [Government of United States of America]
7470	SPM	13	30	13	31	Please check “The level and timing of increased plant growth and replenishment of soil may compensate, in part, for permafrost carbon losses (high confidence)” (“There is medium evidence but with low agreement whether the level and timing of increased plant growth and replenishment of soil will compensate these permafrost carbon losses.” in page 2 – 4 of Chapter 2) [Government of Japan]
8442	SPM	13	33	13	36	We salute the mentions ot 1) decresed stability of slopes, 2) increase in glacier lakes, and 3) new occurrences of associated landslides and floods, as they are important for Peru, particularly in association with the increased risk for glacial lake outburst floods. [Government of Peru]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6842	SPM	13	33	13	40	KEY ISSUE [CONFIDENCE]: This confidence level is excessively conservative. While the volume of literature on these specific topic is still small, process studies over decades can be added to the body of evidence that justifies a high confidence rating. [Government of United States of America]
6844	SPM	13	33	13	40	In its current form, this statement is inaccurate as the studies used to form it are spatially constrained, and only represent some mountainous areas in Europe. The statement should/must be spatially qualified with the confidence rating thereby justified. [Government of United States of America]
6846	SPM	13	33	13	40	B4.1 is vague, and not written in a way that will be particularly useful for policymakers. [Government of United States of America]
6848	SPM	13	33	13	40	The concluding sentence that states "alpine species persistence and ecosystem services will depend upon appropriate conservation and adaptation measures" exemplifies the problems of being overly vague. So, for species persistence, what is an appropriate conservation measure that would prevent the extinction of alpine species with warming? Adding more land in conservation, moving populations, reducing mortality events due to humans, disease, etc.? For alpine ecosystem services, do we adapt to their loss, or are we adapting their reduction in quantity and quality which helps those services persist? The last sentence in particular should be bolstered with some specifics or examples to help a reader understand to some degree what exactly is being implied. [Government of United States of America]
6850	SPM	13	33	13	40	The simple assumption of upslope migration doesn't account for microclimates and shifts to other mountain aspects that have been documented for some alpine species. These two sentences would benefit from one concrete example. [Government of United States of America]
7966	SPM	13	34			delete "high-mountain" from before slopes. The whole paragrpah is about high mountains. [European Union]
7968	SPM	13	34			replace "and" with "as well as" [European Union]
3292	SPM	13	35	13	35	In the context of retreat of glaciers and permafrost thaw, it is unclear why floods are mentioned here and what kinds of floods are being referred to. Too much knowledge about physical processes is being assumed of the reader. [Government of Canada]
5152	SPM	13	35	13	35	pls. revise: (medium confidence) in (high confidence) (p. 2-39) [Government of Germany]
812	SPM	13	35	13	36	We suggest mentioning more explicitly the glacier lake outburst floods (GLOFs) See chapter 2, subsection 2.3.2.1.3 [Government of France]
6852	SPM	13	35	13	36	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
680	SPM	13	36	13	38	We suggest adding in part A nowdays observations regarding avalanches 2-38 "In summary, in particular in Europe, there is medium confidence in an increase in avalanche activity involving wet snow, and a decrease in the size and run-out distance of snow avalanches over the past decades." [Government of France]
814	SPM	13	36	13	38	Please consider rephrasing this sentence as it is currently ambiguous. In section 2.3.2.1.2, it is mentioned that "the probability of occurence of occasionally large snow precipitation events is projected to remain possible throughout most of the 21th century." The redaction of B1.4 could be interpreted as a disparition of the avalanche risk, wich will be confusing. We suggest: "Projected changes in snow avalanches include a decline of their number and runout distance. However, large snow precipitation events is projected to remain possible throughout most of the 21th century. A higher proportion snow avalanches involving wet snow is projected, even in winter. [Government of France]
2840	SPM	13	37	13	37	Suggested edit: 'and runout distance, as snow volume decreases, and more frequent..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
6854	SPM	13	38	13	40	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
2842	SPM	13	39	13	39	It seems strange that rain on snow floods will be less frequent at lower elevations as water flows downhill. Are these less frequent at lower elevations and more frequent at higher because snow is being lost at lower elevations? A brief clarifying reason would be useful here. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5154	SPM	13	40	13	40	pls. revise: (high confidence) in (medium confidence) (p. 2-40) [Government of Germany]
7970	SPM	13	42			River runoff is the subject, not the basins, use “is” (instead of are) [European Union]
6856	SPM	13	42	13	42	"are" should be changed to "is". [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5156	SPM	13	42	13	47	The very general statement "average annual runoff from glaciers in most mountain regions will have reached a peak that will be followed by declining runoff at the latest by the end of the 21st century" does not address the important fact that many glaciated areas are already or will be peaking before mid-century, nor does it differentiate between high and low emission futures. We'd welcome a slight extension of this statement based on material in Chapter 2-25 "There is robust evidence and high agreement that peak water in glacier-fed rivers has already passed with annual runoff declining especially in mountain regions with predominantly smaller glaciers, for example, in the low latitude Andes (Frans et al., 2015; Polk et al., 2017), western Canada (Fleming and Dahlke, 2014; Brahney et al., 2017) and the Swiss Alps (Huss and Fischer, 2016). A global modelling study (Huss and Hock, 2018) suggests that peak water has been reached before 2019 for 82-95 % of the glacier area in the low latitude Andes, 40-49 % in Western Canada and USA, and 55-67 % in Central Europe and the Caucasus (Figure 2.6)." and Figure 2.6, indicating the consequence of reduced glacier melt under RCP2.6 compared to RCP8.5. [Government of Germany]
6858	SPM	13	42	13	47	There will also be areas (such as in the Andes, etc.) where glacier loss is going to be so severe that overall resources are way down. This summary fails to provide a balanced presentation indicating that snow cover and winter snowpack are decreasing in many areas as the subtropics tend to expand and overall aridification occurs. Ignoring a statement of the problem areas by giving changes for "most" areas really hides the regional impacts that will be occurring. Are there really any areas that will end up with net beneficial impacts due to the timing of what is happening? In areas such as the Sierras, the occasional occurrence of heavy snowpack necessitates lowering reservoirs in order to protect occurrence of heavy rain on snow events that can lead to severe flooding, so that a lot of the incoming precipitation is not really available as water resources due to the need to provide flood protection. This summary here is overly simplified and really hides key impacts facing society. [Government of United States of America]
3714	SPM	13	45	13	47	Is projected to have peaked rather than will have [Government of Ireland]
6860	SPM	13	45	13	47	If these statements concern projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
6862	SPM	13	46	13	46	Remove "at the latest". [Government of United States of America]
4734	SPM	13	47			Footnote 7 should please provide the temperature and emissions related to the RCP2.6 and RCP8.5. We would also highly appreciate an explanation why the SROCC SPM does not provide information related to 1.5°C and to the warming that would follow from the implementation of the NDCs, i.e. probably less than 3°C. Please see also our other comments on the choice of the RCPs. [Government of Germany]
4580	SPM	14	0	14		Suggestion to let B2.4 and B2.5 follow from B2.2, as the are closely connected (stratification, primary production and carbon uptake. B2.3 is closer to 'new ocean climate'.'change the chronology: first B22 then B24, then B25 and then 523 [Government of Belgium]
4046	SPM	14	1	14	1	Consider adding a statement on increase in precipitation extremes and increase in rain-on-snow events (ref SROCC 3.4.2.3) [Government of Norway]
4044	SPM	14	1	14	8	The albedo effect and the impact of this on loss of sea ice and ocean warming is not mentioned in the SPM. Please consider including this. However, it might fit better in an other section. This section is only a suggestion. [Government of Norway]
3560	SPM	14	1	19	45	The reach of the SPM could increase if the assessed impacts on species, ecosystems, ec., and the key functions of these species and ecosystems were somehow expressed or explained in reasonable extent. For many readers, it would undoubtedly increase the understanding of the matter. [Government of Sweden]
7972	SPM	14	2			Insert: [...] the 21st century and beyond [...] [European Union]
6864	SPM	14	2	14	2	Replace "with future changes such as" with "concomitantly with". [Government of United States of America]
4648	SPM	14	2	14	4	Suggested correction: 'The ocean is projected to continue to warm throughout the 21st century, with further changes such as loss of Arctic sea ice, loss of oxygen, increased acidification, increasingly frequent marine heatwaves (high confidence) and weakening of the Atlantic meridional overturning circulation (medium confidence)'. [Government of Russian Federation]
5158	SPM	14	2	14	4	The listing of changing properties is given with "high confidence": is it correct for "loss of oxygen" and "marine heatwaves"? [Government of Germany]
682	SPM	14	2	14	8	No mention on the methane hydrates (or marine permafrost) is done. This risk should be mentionned. [Government of France]
3294	SPM	14	2	14	8	B2 headline: recommend using lines 46-48 on page 14 in the headline on future ocean changes. Suggest this could replace the sentence about increased stratification, which may not resonate as much with policymakers. [Government of Canada]
3716	SPM	14	2	14	8	Suggest this is clearly linked to additional energy being trapped by long life GHGs [Government of Ireland]
3718	SPM	14	2	14	8	Message can be clearer and stronger based on material in the report also links to LLGHGs should be clearer [Government of Ireland]
5160	SPM	14	2	14	8	We would recommend to insert a statement similar to the first lines of para B2.6 "...The Ocean will experience a new ocean climate..." here as a start for the headline statement B2. It seems like a more appropriate summary of the processes described in B2.x than the current generic list of processes. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5162	SPM	14	2	14	8	The B2 message has clear descriptions of the projections until 2100. Since climate change will not stop then, an indication on the potential development post-2100 may be important for policy-makers. [Government of Germany]
5448	SPM	14	2	14	8	Please specifically reflect the increased risks for the tropical oceans as it refers to more extreme ENSO events and heat waves. [Government of Saint Kitts and Nevis]
6866	SPM	14	2	14	8	In the B2 summary one would expect some content from 6.6 (Inter-Ocean Exchanges and Global Change). Page 6-41 states "Under 1.5°C warming both El Niño and La Niña frequencies may increase (see Section 6.5) and hence ITF variability may also increase." [Government of United States of America]
6868	SPM	14	2	14	8	Authors should consider a B2 subsection (between B2.7 and B2.8) detailing some of the impacts associated with increasing frequency of ITF variability. Section 6.6.2 has a long list of impacts with confidence of "likely", such as: "Interannual to decadal variability of Indo-Pacific SST variability is likely to affect extreme hydroclimate in East Africa (Ummenhofer et al., 2018). The Pacific cooling pattern is often synonymous with predominance of La Nina events in 1998 and 2012 is linked to megadroughts in the United States (Baek et al., 2019). On decadal to multidecadal time scales, PDO/IPO and Atlantic variability may have impacts on megadroughts in North America (Coats et al., 2016; Diodato et al., 2019) and Australia (Vance et al., 2015) as well as Indian subcontinent (Bao et al., 2015; Joshi and Rai, 2015). It is likely that occurrence of megadroughts in North America and Australia increased (Kiem et al., 2016; Baek et al., 2019)." [Government of United States of America]
6870	SPM	14	2	14	8	Has the gravity of the impacts on marine ecosystems been adequately captured in the B2 summary statement? [Government of United States of America]
8510	SPM	14	2	14	8	The variations of the projected warming of the Ocean is critical for Kiribati, therefore we wish to retain this statement as it is [Government of Kiribati]
8612	SPM	14	2	14	8	Add first two sentences of B2.8 to B2 [Government of Netherlands]
1092	SPM	14	4			Suggest removing jargon here and elsewhere: e.g. "stratification" [Government of Australia]
3658	SPM	14	4	14	4	Replace "Atlantic meridional overturning circulation" with "AMOC" [Government of Brazil]
684	SPM	14	4	14	5	one word about carbon uptake might be helpful here. Published litterature suggest that stratification may damp carbon uptake and hence limiting the impact of ocean acidification on deep marine ecosystems [Government of France]
3296	SPM	14	4	14	6	I would think that increased acidification would logically follow from increased stratification as well. Should that be noted here? Cross-reference to B2.5? [Government of Canada]
2870	SPM	14	5	14	5	The term 'net primary production' appear here and throughout much of the rest of the SPM, but it may not be easily understood by a non-expert, so should be clarified or defined. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6872	SPM	14	5	14	5	Insert "concentration" after "ocean oxygen ". [Government of United States of America]
4362	SPM	14	5	14	7	Is it useful? It seems quite logical that the rate and magnitude would be higher when the emissions are higher. [Government of Monaco]
6874	SPM	14	5	14	7	Change "a" to "the" since only two scenarios are mentioned? Explicitly indicate the emissions scenarios (8.5 and 2.6). [Government of United States of America]
1358	SPM	14	5	14	8	Please provide figures for changes in ocean warming for different scenarios, in particular for 1.5°C and 2°C scenarios. [Government of Luxembourg]
4060	SPM	14	5	14	8	Key message says that ocean changes are projected to increase far more under a high emission scenario than under a low emission scenario. Is it possible to quantify? [Government of Norway]
2854	SPM	14	5	15	5	Suggested edit: will alter ocean oxygen availability, nutrient availability and net primary production' [Government of United Kingdom (of Great Britain and Northern Ireland)]
7974	SPM	14	7			Box B2: "far more": would it be possible to indicate an order of magnitude or being more concrete? [European Union]
3480	SPM	14	10	14	11	The "The direct relationship… provides a basis for estimating" would seem to be detail that rather confuses than adds to the key information. Delete? [Government of Sweden]
686	SPM	14	10	14	13	B2.1 is very focussed on Arctic multi-year ice. There is comparatively less info on Arctic ice volume, ice-free season duration, snow cover, etc… Maybe one sentence to mention that there are other expected changes in sea ice scape would be valuable. [Government of France]
1482	SPM	14	10	14	13	It is unclear what is intended by "…provides a basis for the probability of a sea ice free Arctic ocean in September to be around 1% each year…". The original phrase from section 3.2.1 is much clearer and seems to me to have a different meaning: "For stabilised global warming of 1.5°C, an approximately 1% chance of a given September being sea ice free at the end of the century is projected; for stabilised warming at a 2°C increase, this rises to 10-35% (high confidence)." [Government of Italy]

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Comment id	Chapter	From page	From line	To page	To line	Comment
6876	SPM	14	10	14	13	This is an inadequate portrayal of what is happening to the sea ice. Focusing on September minimum sea ice is a distraction from what is occurring year-round due to thinning of sea ice, and vast periods during much of the year with very low quality ice leading to very significant warming in the region and impacts on Northern Hemisphere weather, impacts on reproduction and general health of marine mammals (and the food chain that supports them), etc. Add a sentence about the changing character of sea ice on the people and organisms that depend on it. [Government of United States of America]
7472	SPM	14	10	14	13	Based on Figure SPM.1 (l), the Arctic sea ice extent for RCP2.6 (which would correspond to the global warming of 2°C) does not seem to touch the zero line, even including the uncertainty range. Therefore, it does not seem very convincing that the probability of the ice-free Arctic sea in September is as high as 10 – 35%. Consistency and clarification would be suggested between the Figure SPM.1 (l) and the description in B2.1. [Government of Japan]
3298	SPM	14	10	14	15	The wording for the likelihoods of ice-free summers in the Arctic is confusing. The text in the report is much clearer. In particular, the statement that the probability of an ice-free Arctic is 'around 1% each year for stabilized global warming' could be misinterpreted to mean that the probably increases by 1% each year. [Government of Canada]
3482	SPM	14	10	14	15	Consider moving the sea ice discussion into B1. [Government of Sweden]
4084	SPM	14	10	14	15	Consider also adding projections for sea ice under a high emission scenario (RCP8.5) [Government of Norway]
2856	SPM	14	11	14	12	Suggested edit: 'a basis for estimating the changing probability each year of a sea ice free Arctic...' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4364	SPM	14	11	14	12	Error in this sentence: what is a probability of 1% each year ? Should be replace by: "Is it 1% chance of a given September being sea ice free at the end of century" (Chapter3, p.5) [Government of Monaco]
688	SPM	14	12	14	12	What is a probability of 1% each year ? This is not clear. Should be replaced by: "1% chance of a given September being sea ice free at the end of century" (chapter3 - page 5) [Government of France]
2858	SPM	14	12	14	12	What does 1% each year means? An increasing probabilty each year? But presumably not ad finitum and also by when when the Arctic be likely ice free in September? SR1.5 communicates this finding in simpler language - B2.1 could be rephrased to be more in line with that language for consistency and ease of understanding ("There is high confidence that the probability of a sea ice-free Arctic Ocean during summer is substantially lower at global warming of 1.5°C when compared to 2°C. With 1.5°C of global warming, one sea ice-free Arctic summer is projected per century. This likelihood is increased to at least one per decade with 2°C global warming.") [Government of United Kingdom (of Great Britain and Northern Ireland)]
5164	SPM	14	12	14	12	pls. insert: ...each year at the end of the century for stabilised ....(p. 3-25) [Government of Germany]
6878	SPM	14	12	14	13	Sentence should be rewritten to explicitly make the point that p(sea-ice free Arctic for any given September) is very small (<1%) at +1.5°C and much higher (>10-35%) for +2°C. [Government of United States of America]
4650	SPM	14	12	14	14	Suggestion: to add 'of years' after '1%' [Government of Russian Federation]
5166	SPM	14	13	14	13	The „high confidence" level for the projected likelihood of an ice-free Arctic Ocean is inconsistent with the main chapter in section 3.2.2.1., where no confidence level is given for the specific numbers. Indeed, we would argue that we only have low confidence on these specific estimates because of the models inability to faithfully reproduce the observed evolution. The executive summary of chapter 3 gives „high confidence" for this statement, but this is not consistent with the main text. Please revisit the chapter and ES to ensure the confidence levels provided here are consistent with the assessment of the main text, and revise accordingly in the SPM. [Government of Germany]
2860	SPM	14	14	14	15	Suggested additon: 'representation in climate models of key processes involving the atmosphere, ocean, and interactions with the adjacent ice sheet, although observations clearly indicate a declining volume of land ice in the Antarctic.' [Government of United Kingdom (of Great Britain and Northern Ireland)]
7474	SPM	14	15	14	15	The reference number would be 3.2.2, not 3.2.1. [Government of Japan]
7978	SPM	14	17			Insert: [...] the 21st century and beyond [...] [European Union]
7980	SPM	14	17			"upper ocean": it could be relevant to define the upper ocean in a footnote (connection between the surface and the deeper ocean) [European Union]
5446	SPM	14	17	14	18	The two statements should be separated. The confidence of the statement that "The ocean will continue to warm throughout the 21st century" should be higher, probably virtually certain. [Government of Saint Kitts and Nevis]
3484	SPM	14	17	14	20	Please clarify if these are cumulative uptakes. [Government of Sweden]
948	SPM	14	17	14	22	This sub bullet is confusing and should be simplified. [Government of Jamaica]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3300	SPM	14	17	14	22	"… the ocean is projected to take up 2 to 4 times as much heat … as the observed accumulated heat uptake since 1970": Expressing ocean warming in this way may have limited value for a policy maker. It is understood that the absorbed heat would be distributed differently over depth and vary around the globe, but perhaps a projected temperature change averaged over the top 2000 m globally might be more easily assimilated by the reader, especially in comparison to the same metric calculated for 1970 to the present. [Government of Canada]
6880	SPM	14	17	14	22	There is no explanation of what stratification means for society or for life in the ocean. The explanation provided in lines 29-30 should not be separated from this statement and a more informative word than "alter" needs to be used (i.e., in what direction is the change). [Government of United States of America]
5168	SPM	14	17	14	36	Both B2.2 and B2.4 give information about the impacts of stratification. The paragraphs should be combined or at least follow directly after each other. [Government of Germany]
7976	SPM	14	17	14	36	Explain what "stratificaiton" means and how it is quantified whan quantitative changes are reported (area, duration within a year, the degree of separation of layers, etc). [European Union]
7476	SPM	14	17	15	4	Projected ocean stratification is described for RCP2.6 and RCP8.5. It is desirable that those changes are described also for other RCPs. [Government of Japan]
5170	SPM	14	18	14	20	to avoid the mismatch of using the terms 'rates of warming' and 'rates of heat uptake' it is proposed to cite the original text: By 2100 the ocean is very likely to warm by 2 to 4 times as much for low emissions (RCP2.6) and 5-7 times as much for high emissions scenario (RCP8.5) compared with the observed changes since 1970. With the RCP8.5 scenario, the ocean is very likely to take up about twice as much heat as RCP2.6. (p. 5-16) [Government of Germany]
2872	SPM	14	20	14	20	It is unclear to a non-expert what is meant by 'annual-mean stratification'. Please define. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6882	SPM	14	20	14	20	Should this be "…ocean heat uptake FROM 1970 TO THE PRESENT…"? [Government of United States of America]
7478	SPM	14	20	14	20	It is desirable to explain the definition of annual mean strartification. [Government of Japan]
1094	SPM	14	20	14	21	Suggest providing additional context. Stratification in the ocean is a measure of stability and associated with density - what does a 1 to 9% increase mean? How much density change is required to lead to that increase? Or how much temperature/salinity change? [Government of Australia]
690	SPM	14	20	14	22	This sentence needs clarification. Please clarify the unit. Are there different definitions of stratification? If yes, it should be added after % "when expressed in Squared Buoyancy Frequency" (same comment as in A2.5) [Government of France]
7982	SPM	14	20	14	22	B2.2 Stratification in itself is not a meaningful concept for non-experts. Whenever mentioned in the SPM, it should therefore be linked to a discussion of its relatable consequences. In particular, this paragraph introduces quantified stratification (% increases). It is not clear what the units of stratification are - nor is it explained in the glossary. [European Union]
8632	SPM	14	20	14	22	It is unclear whether these percentages refer to the depth, the length or e.g. the strength of stratification (or a combination thereof). [Government of Netherlands]
1484	SPM	14	21	14	21	It is unclear what the statistical significance of 1% would be and if it makes sense to report it here, especially as it is considering an averaged stratification. [Government of Italy]
2874	SPM	14	21	14	21	60S - 60N is a really big area to be averaged over and covers some very different environments oceanic conditions (gyres, the North Pacific vs the North Atlantic). It might be helpful to point out the regions/systems where increased stratification is most likely to be an issue. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4366	SPM	14	21	14	22	What an increase by x% in stratification means? [Government of Monaco]
692	SPM	14	23	14	36	To improve the continuity of topics, please consider moving paragraph B2.4 after B2.2, aslo talking about stratification. The present B2.3 paragraph could go above B2.7 which deals with El Nino. [Government of France]
6884	SPM	14	24	14	14	Delete the comma after "heatwaves". [Government of United States of America]
5440	SPM	14	24	14	25	The emergence of a 'new ocean climate' over the 21st century with high confidence is a key finding of this report. Should be lifted up into top level statement B2. [Government of Saint Kitts and Nevis]
6012	SPM	14	24	14	25	In this sentence, the frequency of marine heatwaves is expressed by a factor of approximately. For readability, it is necessary to express a factor with a unit(eg : days), otherwise a description of the factor of approximately is needed. [Government of Republic of Korea]

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6886	SPM	14	24	14	26	Because this finding regarding marine heatwaves is statistically quantitative, it would help to remind readers of the definition of marine heatwaves. [Government of United States of America]
950	SPM	14	24	14	27	This sub bullet uses the word factor to indicate the increased frequency of marine heatwaves but numbers would be better understood. [Government of Jamaica]
6888	SPM	14	24	14	27	Suggest adding a sentence that the intensity of heatwaves is projected to increase. [Government of United States of America]
6890	SPM	14	24	14	27	It may be appropriate to mention the negative expected impact on tropical coral reefs health because of the projected increase in MHW frequency in the tropical ocean. Also this is probably the best place to add that "Given that MHWs will very likely increase in intensity and frequency with further climate warming, we conclude with high confidence that this will push some marine organisms, fisheries, and ecosystems beyond the limits of their resilience." See pages 6-32 to 6-33, paragraph starting with "Based on the examples described above..." [Government of United States of America]
6892	SPM	14	24	14	27	Using the preindustrial reference period should be the standard throughout. The meaning and significance of marine heatwaves needs to be explained to make accessible to policymakers. [Government of United States of America]
8444	SPM	14	24	14	27	The enormous projected increase in frequency of marine heatwaves, such as the "coastal El Niño", is very worrisome for Peru and we salute this mention. [Government of Peru]
4636	SPM	14	26	14	26	Comparing expected by 2081-2100 changes in marine heat wave frequency with its frequency in 1850-1900 period is of a little practical meaning. Are there results for present day conditions? [Government of Russian Federation]
7984	SPM	14	26	14	26	Here reference time 1850-1900 is used, this should be instead based on similar reference periods as in other comparisons, or taken out [European Union]
2862	SPM	14	27	14	27	Is a heatwave is defined as a departure from the average for a location rather than an absolute value? Please unpack this statement. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1096	SPM	14	29	14	29	Suggest rephrasing to read "Increased stratification of the upper ocean under RCP8.5 is likely to alter nutrient availability ..." or “Increased stratification of the upper ocean under RCP8.5 is projected to alter nutrient availability ..." We don't know what WILL happen. These projections must be communicated in probabilistic terms. [Government of Australia]
4368	SPM	14	29	14	29	B2.4 - To improve the continuity of topics, move this paragraph after the B2.2, aslo talking about stratification. The present B2.3 paragraph will then add another topic (marine heatwaves). [Government of Monaco]
6894	SPM	14	29	14	30	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
6016	SPM	14	29	14	32	This part addressed the changes by stratification including oxygen loss, however oxygen loss is also affected by other factors, such as increasing heat content. Moreover oxygen loss is addressed in the latter part of B2.6 from line 48 to 51. It seems better to addrss 'ocean oxygen loss' content' as one separated paragraph by aggregating related parts. [Government of Republic of Korea]
3302	SPM	14	29	14	36	B2.4: Declining nutrient availability under RCP2.6 is described as "likely as not" reduced relative to RCP8.5. Is this consistent with the rest of the text? [Government of Canada]
3304	SPM	14	29	14	36	The addition of a new panel on ocean deoxygenation (panel 5.8d to go into lower left corner of figure SPM.1) could be best referenced right here, where it is said that "By 2081-2100 under RCP8.5, globally averaged ocean oxygen 31 is very likely to decline by 3-4 %". On line 36 of page 14, we suggest to replace "Figure SPM.3" with "Figures SPM.1 and SPM.3". [Government of Canada]
7986	SPM	14	29	14	36	B2.4 - see also comment above on B2.2. This paragraph should be split in two. The first part, on stratification, should be moved to statement B2.2 in order to make that statement meaningful to non-experts. The remaineder (a statement on primary production) should therefore be standalone. However, as mentioned in our other comments, it would be better to place together all A&B comments on a specific theme (such as producitivity of oceans/fisheries). Also, how can the 4-11% range be simultaneously 'very likely' and 'low confidence'? [European Union]
8570	SPM	14	29	14	36	This statement is very important for PSIDs like Kiribati, that is highly dependent on tuna resources as the major source of economy [Government of Kiribati]

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5172	SPM	14	29	14	37	In this statement some global numbers of oxygen, nutrient and NPP declines are presented. The global aggregate declines are rather small - and confidence is not very high, given ongoing challenges with modelling these processes. It may make more sense to focus on the differences between tropical regions and higher latitudes instead of reporting global aggregate numbers. It would be helpful if the authors could provide an assessment accompanying the numbers, helping the reader to interpret their meaning. [Government of Germany]
2886	SPM	14	30	14	31	The section tells us globally averaged ocean oxygen will decline by 3-4%. It is unclear what baseline this is compared to, please specify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8422	SPM	14	30	14	32	Replace: "By 2081-2100 under RCP8.5, globally averaged ocean oxygen is very likely to decline by 3-4 % (medium confidence) relative to 2000 and upper ocean nutrients are projected to decline by 9-14% relative to 2006 - 2015, especially in the tropics (medium confidence)."[sections 5.2.2.4, 5.2.2.5] [Government of Peru]
5174	SPM	14	31	14	31	pls. insert: ...by 3-4%, relative to 2000 (medium confidence). [Government of Germany]
6014	SPM	14	31	14	31	In this sentence, there is no range for upper ocean. This part should be needed to be supplemented. [Government of Republic of Korea]
2864	SPM	14	31	14	32	Does this account for input from runoff (e.g. pollutants and agricultural run-off)? If not, please mention that these aren't included in this statement. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5176	SPM	14	31	14	32	pls. revise: ...and upper ocean nitrate content is projected to decline by 9-14% (RCP8.5) or 1.5-6% (RCP2.6) relative to 2006-2015. (p.5-37) [Government of Germany]
6896	SPM	14	31	14	32	Declines are relative to what baseline? [Government of United States of America]
6898	SPM	14	31	14	34	"decline by 3-4 %" and "projected to decline by 9-14%" and "4-11% by 2081-2100"-- What are these percentage declines measured against? Total net change since the preindustrial? Or an additional change from present? Or the change anticipated between 2081-2100? [Government of United States of America]
3306	SPM	14	32			The decline cannot be 9-14% 'especially in the tropics'. Please revise. [Government of Canada]
4188	SPM	14	32	14	33	It says that global net primary production will decline in response to a combination of environmental drivers. It would be interesting if the sentence also listed which drivers they are referring to, maybe in a parantheses? [Government of Norway]
694	SPM	14	32	14	34	Please check the confidence and likelihood statements as "very likely" does not sound to go with "low confidence" [Government of France]
6900	SPM	14	32	14	34	Is this for RCP8.5? State which scenario. [Government of United States of America]
6902	SPM	14	32	14	36	Does the "combination of environmental drivers" include non-climate change-related processes? If so, clarify. [Government of United States of America]
5178	SPM	14	33	14	33	pls. insert: ...by 2081-2100 under RCP8.5 (low confidence). (5.39) [Government of Germany]
6904	SPM	14	33	14	34	"very likely" and "low confidence" appear in the same sentence. [Government of United States of America]
696	SPM	14	34	14	35	Please consider moving "net primary production" before "nutrient availability" as it is more confident. The sentence could be rephrase as "reduced for oxygen loss (very likely) and net primary production (confidence level), uncertain for nutrient, compared to RCP8.5" [Government of France]
2888	SPM	14	34	14	36	This section tells us oxygen, nutrient and production losses under RCP2.6 will be reduced compared to RCP8.5. Would it be possible to quantify the losse for these RCP2.6 projections? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4582	SPM	14	34	14	36	Why not including figures for the RCP2.6 scenario, as they are included for the RCP8.5 scenario? [Government of Belgium]
5180	SPM	14	34	14	36	Rewording: Under RCP2.6, global projected changes by 2081-2100 are smaller/lower for oxygen loss (very likely), nutrient availability (likely as not) and net primary production compared to RCP8.5 (high confidence). [Government of Germany]
6906	SPM	14	34	14	36	Give number values for the change, as done the sentence prior. [Government of United States of America]
134	SPM	14	35	14	35	It is suggested to substitute "likely as not" by "about as likely as not". [Government of Austria]
2866	SPM	14	35	14	35	If 'likely as not' for nutrient availability why does it say 'reduced' at the start of the sentence. It might be worth separating this impact from changes in oxygen loss and net primary production to avoid confusion. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8320	SPM	14	38	14	38	Replace "carbon" with "carbon dioxide" [Government of New Zealand]
4200	SPM	14	38	14	40	Possible to state pH change by percentage in addition to pH-units, as pH-unit is not necessarily something the reader (policymakers) is aquainted to? [Government of Norway]
952	SPM	14	38	14	44	Impact on coral reefs especially in the tropics will be very significant and therefore should be included in this bullet. [Government of Jamaica]
3720	SPM	14	38	14	44	Refer to CO2 uptake rather than carbon or if carbon is needed speak of fraction which is CO2 and then carbon from other sources. [Government of Ireland]

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6908	SPM	14	38	14	44	B2.5 bracketed references should also include 3.2.2/3.2.2.3 (Carbon and Ocean Acidification), which is the main subsection devoted to the aragonite discussion: "The Arctic and Southern Ocean have a systemic vulnerability to aragonite undersaturation (Orr et al., 2005). For the RCP8.5 scenario, the entire Arctic and Southern Ocean surface waters will very likely be typified by year-around conditions corrosive for aragonite minerals for 2090-2100 (Figure 3.4) (Hauri et al., 2015; Sasse et al., 2015), whilst under RCP2.6 the extent of undersaturated waters are reduced markedly. At a basin/circumpolar scale, there is high confidence in these projections due to our robust understanding of the driving mechanisms. However, there is medium confidence for the response of specific locations, due to the need for improved resolution of the local circulation, interactions with sea ice, and other processes that modulate the rate of acidification." [Government of United States of America]
6910	SPM	14	38	14	44	The boxes in Figure SPM.2 indicating high confidence for decreasing pH in the Southern Ocean are problematic. There are not that many long-term time series for oceanic inorganic carbon in the Southern Ocean and new data recently collected during the cold seasons add to uncertainties in the quantification of the carbon cycle in this region. In the West Antarctic Peninsula, there are no significant trends in carbonate cycle over the past 2 decades. There are so many gaps in the spatial and temporal coverage of data collection that it is hard to justify the change as high confidence. Although there are modeling studies that indicate decreasing pH, validating sea ice and primary production is really challenging as well. [Government of United States of America]
5182	SPM	14	38	14	49	Please put in context what 0.3 pH units means: a drop of 0.1 pH units, representing a 25-percent increase in acidity? [Government of Germany]
3308	SPM	14	39			The probability that the pH decrease will be exactly 0.3 units is zero. The authors need to specify a range associated with the quantified estimate of likelihood (virtually certain, P>=99%). [Government of Canada]
6912	SPM	14	39	14	39	"pH is virtually certain to be 0.3 pH units" -- Specify relative to what period (preindustrial vs. current). It's important to note that this is a global open ocean mean and changes along coastal margins may differ. It should also be noted that pH is the least useful of metrics to gauge ocean acidification. Perhaps aragonite saturation state would be better. [Government of United States of America]
2876	SPM	14	39	14	40	Which baseline is the 0.3pH unit decrease relative to? (today or pre-industrial?). Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2890	SPM	14	39	14	40	This section tells us the projected decrease in open ocean pH will be 0.3 pH units. Is this in relation to the graph (Section A, page 4) that shows current surface ocean pH to be ~8.1? Please specify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6914	SPM	14	39	14	40	"The projected decrease in surface open ocean pH is virtually certain to be 0.3 pH units under RCP8.5 by 2081-2100." Relative to the preindustrial period? [Government of United States of America]
8322	SPM	14	39	14	40	Change the order slightly such that the sentence reads "....to be 0.3 pH units by 2081-2100 under RCP8.5" [Government of New Zealand]
2868	SPM	14	40	14	40	is it possible to expand this statement to something such as: 'by 2081-2100, equivalent to an x-fold increase in hydrogen ion availability (acidity), if the literature allows? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4370	SPM	14	40	14	40	"corrosive": Is this term relevant in a document for non-scientific? It could suggest that the seawater will really become acidic. Corrosive is a term that should be only related to the notion of CaCO3 saturation. [Government of Monaco]
8424	SPM	14	40	14	40	before the period: "relative to 2006 - 2015." {section 5.2.2.3.2}] [Government of Peru]
7988	SPM	14	40	14	41	Explain what the mentioned "year-round corrosive conditions" imply, why the mentioned organisms are important, why in the mentioned regions (and what happens in the other regions?). Also, what happens under other pathways, when would these conditions set in (never or just after 2100?). [European Union]
6916	SPM	14	40	14	42	In addition to referencing impacts to aragonite shell producing biota, it might also be relevant to include that OA can have a variety of behavioral and physiological impacts on a range of marine organisms, including important fisheries species. [Government of United States of America]
698	SPM	14	41	14	41	What is the meaning of Southern here ? Southern Ocean? Hemisphere ? PAcific ? Would be worth clarifying. [Government of France]
5184	SPM	14	41	14	41	Please provide example for aragonite shell producing organisms. [Government of Germany]
8204	SPM	14	41	14	41	correct - "open oceans regions of the Arctic" to "regions of the open oceans of Arctic" [Government of India]
3660	SPM	14	41	14	46	Replace "Southern" with "Southern Ocean" and replace "a of" with "of a" [Government of Brazil]
700	SPM	14	42	14	42	"undersaturated": Please specify in relation to what it is undersaturated. Is it calcium carbonate undersaturation? It would be helpful for the understanding to clarify. [Government of France]
6918	SPM	14	42	14	42	Shift to understaturated conditions throughout the water column and global ocean? Or some other extent? A little more detail is needed here. [Government of United States of America]

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6920	SPM	14	42	14	42	"shift to undersaturated" -- Should this say permanent or year-round shift to undersaturated or something of that nature? There would still more than likely be episodic undersaturation events regardless, correct? [Government of United States of America]
2878	SPM	14	42	14	43	A policymaker is unlikely to understand the term 'undersaturated conditions and how this relates to pH change and vulnerability. Please unpack this statement to make this clearer. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7990	SPM	14	42	14	44	Incomprehensible sentence – example of inaccessible text that should not be part of the SPM. [European Union]
1098	SPM	14	46	14	46	Suggest correction of typo: “During this century, the ocean will experience the emergence of a new ocean climate…”. [Government of Australia]
1488	SPM	14	46	14	46	It is not clear what is meant by a "new ocean climate" compared to "preindustrial climate variability" since the paragraph is relative to oxygen loss. [Government of Italy]
2882	SPM	14	46	14	46	B2.6 talks about the emergence of a new ocean climate, but gives no details of where in the ocean this will emerge, or what features it will have. This should be elaborated and made one of the headline statements, as it is a very important message of the report. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4372	SPM	14	46	14	46	B2.6. The concept of time of emergence is not a well-know concept, and definitly not relevant to mention in SPM. It can be misunderstoof and lead to confusion with deoxygenation. Not sure it is necessary to present this concept in SPM, so paragraph can be delete. [Government of Monaco]
4374	SPM	14	46	14	46	"a". Typographical error. Replace: "the emergence of new ocean" [Government of Monaco]
4638	SPM	14	46	14	46	"a of" typo [Government of Russian Federation]
5186	SPM	14	46	14	46	The wording of a "new ocean climate" might be ill chosen, unclear what this means exactly. [Government of Germany]
6922	SPM	14	46	14	46	The words "a" and "of" are reversed. Modify the sentence to: "During this century, the ocean will experience the emergence of a new ocean climate that…" [Government of United States of America]
8324	SPM	14	46	14	46	The phrase "emergence of a new ocean climate" could be interpreted to mean that equilibrium is reached which probably is not the intention. Needs to be clear what is meant. [Government of New Zealand]
4584	SPM	14	46	14	47	The headline statement in B2 should include line 46-47 on p. 14. It could be the opening sentence. [Government of Belgium]
702	SPM	14	46	14	48	Please delete "emergence" and rephrase as "will experience a new ocean climate". [Government of France]
3570	SPM	14	46	14	48	Important finding, should be highlighted in box B2 if possible or moved up in this section. [Government of Brazil]
6924	SPM	14	46	14	48	Clarify the meaning of "new ocean climate". Different regions of the ocean have different climate regimes. Are they all projected to change in the same way? Suggest using phrasing like "is projected to… (likelihood/confidence)" rather than "will…". [Government of United States of America]
6926	SPM	14	46	14	48	This key message needs to be in the chapeau, or even for the whole section on projected changes -- that is, that the changes are "unprecedented". [Government of United States of America]
1568	SPM	14	46	14	49	The entire sentence is not very clear. Not Clear also what is meant by new Ocean Climate. [Government of United Republic of Tanzania]
954	SPM	14	46	14	51	Statement about the emergence of a new ocean climate needs to be given greater prominence because it is a high confidence statement which means that great attention should be given to it. [Government of Jamaica]
2880	SPM	14	46	14	51	This paragraph appears to contradict itself. How can we say that 79-91% of the ocean will experience oxygen loss, and then say it will be detectable in only 60% of it? Are we saying that 19-31% will be at an undetectable level? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3722	SPM	14	46	14	51	Use projected rather than will and explain what a new ocean climate is perhaps include a box on a 2100 ocean which combines the various elements [Government of Ireland]
5188	SPM	14	46	14	51	B2.6 This statement starts with a very bold announcement and then shrinks down to a simple projection for ocean surface oxygen concentrations that are declining when surface water warms. Is it really noteworthy in an SPM that warming surface water will contain less oxygen? Surface ocean oxygen decline is already observed and except for surface, warming is not the dominating factor in oxygen decline (see SPM A 2.7). The first sentence here however seems very suitable as a Headline for the whole section B2. Please consider to rephrase. [Government of Germany]
5190	SPM	14	46	14	51	The content of B2.6 should be revised and moved. The first sentence highlights the general changes in a way it may better fit into B2. The content of the other sentences apply to oxygen loss which is already mentioned in B2.4 and may thus be included there. [Government of Germany]
7992	SPM	14	46	14	51	Why is Oxygen highlighted here, when the previous sentence suggests that different variables will have different emergence? Does the last sentence refer to Oxygen specifically, or across multiple variables? Retain if multiple - if O2 only, then replace with a more generic summary of the degree of emergence. Suggest deleting the oxygen sentence or explain its special significance (or representetiveness) relative to the other "environmental parameters" alluded to. [European Union]

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6928	SPM	14	47	14	47	Does 'unprecedented' have too strong a connotation when comparing to a 50-year period (versus, say, the past 10,000 years)? Be more explicit about the term "new ocean climate". [Government of United States of America]
3486	SPM	14	47	14	48	The "with different environmental parameters emerging at different rates" is rather unclear. Please clarify, or omit for brevity. [Government of Sweden]
1100	SPM	14	48	14	49	Suggest including a confidence statement for the proportion of ocean area experiencing oxygen loss, if possible. [Government of Australia]
2892	SPM	14	48	14	49	This section tells us that oxygen loss will emerge over 79-91% of ocean surface under RCP8.5. Would it be possible to get current spread of oxygen loss to compare to? Also would it be possible to also include projections for a lower emissions scenario (RCP2.6)? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6930	SPM	14	48	14	49	Clarify. Presume both changes are projected for RCP8.5. Can be interpreted as only the second range is for RCP8.5. [Government of United States of America]
2884	SPM	14	48	14	51	The language here is somewhat confusing - further detail on what is meant by 'emerge' could help explain this is 'emerging' from historical/natural variability. It is also confusing when presented against the statistic of changes that are 'detectable' which is for a lower area of the ocean surface? Suggest that the 'detectable' range is removed from the SPM. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3488	SPM	14	48	14	51	How does "79-91% 2081-2100" reconcile with "over 60% by 2081-2100", both being for RCP8.5? [Government of Sweden]
6932	SPM	14	49	14	49	"These changes…" refers to which changes in B2.6? [Government of United States of America]
704	SPM	14	49	14	51	"These changes": It is unclear which changes are mentioned here, one has to look at box 5.1 to find out that it is changes in nitrate and net primary production. It would be best to make this more explicit in the SPM. [Government of France]
1486	SPM	14	49	14	51	In this phrase it is not clear what is referred to with "These changes" as the phrase before referring to oxygen gives other percentages. Is it possible that the sentence refers to the combined detectability of the variables pH, O2, nutrients and NPP (see chapter 5 pg 7 middle paragraph and Henson et al. 2017 Figure 3d)? It is unclear where the 30% for RCP2.6 and 60% for RCP8.5 come from in the underlying chapter. Please clarify the sentence. [Government of Italy]
6934	SPM	14	49	14	51	Suggest rephrasing the first sentence as "Oxygen loss IS PROJECTED TO emerge over 59-80% of the ocean surface by 2031-2050, rising to 79-91% by 2081-2100 under RCP8.5 (VERY LIKELY)." The question of a change remaining detectable in 2100 is a very specific concept to include in an SPM and is only applied to oxygen loss. Why so, and what does detectable mean? Detectable with current instrumentation? Are these two sentences saying that for RCP8.5, from 2081-2100, oxygen loss is projected to emerge over 79-91% of the ocean surface, but would only be detectable over 60% of the ocean surface, or ocean volume? [Government of United States of America]
6936	SPM	14	49	14	51	This statement is obtusely phrased. If the world warms to some level then there is an attempt to bring the temperature back down through carbon dioxide removal, will the process reverse? Will oxygen return? Will the biodiversity losses due to greater change persist? [Government of United States of America]
8640	SPM	14	49	14	51	Delete remain. Adjust the sentence to ""These changes will very likely be detectable for over 30% of the ocean surface under RCP2.6 and for over 60% of the ocean under RCP8.5 bt 2081-2100." [Government of Netherlands]
7480	SPM	14	50	14	50	It would be better to modify "over 60% of the ocean under RCP8.5" to "over 60% of the ocean surface under RCP8.5". [Government of Japan]
8326	SPM	14	50	14	50	Replace "remain" with "be" such that it reads: "...likely to be remain detectable for over 30% of the ocean surface…." [Government of New Zealand]
706	SPM	15	1	15	1	Page 6-35 of the report states that the increase of extreme events has a "medium confidence", which is a fair assessement of current expert knowledge. The fact that this is escalated to "likely" cannot be traced back to the report. [Government of France]
2894	SPM	15	1	15	1	Are extreme La Nina events more frequent under RCP8.5? It seems surprising as La Ninas are largely departures below the average surface historic temp for much of the east of the Pacific. Would we increasingly see departures above the average in most/eventually all years under an 8.5 scenario? Some unpacking of the reason for this would be useful. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6938	SPM	15	1	15	1	Occur more frequently compared to what baseline? [Government of United States of America]
6940	SPM	15	1	15	1	"Extreme El Niño and La Niña events as determined from precipitation anomalies are likely to occur more frequently under RCP8.5…" This nuance needs to be specified, as the "likely" applies to El Niño increases when measured in terms of SST anomalies. While there is some support for an SST anomaly-based finding, it does not rise to the level of "likely". [Government of United States of America]
1102	SPM	15	1	15	4	Suggest including a confidence statement of the increase in these climate events, if possible. [Government of Australia]
1360	SPM	15	1	15	4	This paragraph is missing a confidence statement. [Government of Luxembourg]
1566	SPM	15	1	15	4	Include the confidence level after RCP2.6 [Government of United Republic of Tanzania]

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2910	SPM	15	1	15	4	In B2.7, leaving a mention of RCP2.6 until the end initially gives the impression that extreme events only increase in frequency under RCP8.5. It would be better to say that they occur more frequently under all scenarios, but the increase is greater in higher emission scenarios. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3724	SPM	15	1	15	4	Explain what extreme el nino etc are? [Government of Ireland]
6020	SPM	15	1	15	4	The impact of future ENSO due to climate change is diverse. It is still uncertain the impact of climate change on the future ENSO (intensity, frequency and so on) like Yang et al.(2018). [Government of Republic of Korea]
6942	SPM	15	1	15	4	Overall, B2.7 is consistent with the executive summary of Chapter 6 (page 6-4, 3rd paragraph from the bottom): "Extreme El Niño and La Nina events are likely to occur more frequently with global warming and are likely to intensify existing impacts, with drier or wetter responses in several regions across the globe, even at relatively low levels of future global warming (medium confidence). {6.5, Figure 6.5}". But SPM B2.7 is more explicit, referencing RCP8.5 and RCP2.6. However, Section 6.5 does not have a sufficiently clear discussion that can be linked unambiguously to SPM B2.7. For example, Section 6.5 discusses the increasing frequency of extreme El Niño under a 1.5°C global warming scenario, but without explicitly linking it to RCP8.5 that was discussed in Cai et al. (2014a) (a reference cited in Section 6.5) and that was stated in SPM B2.7. Moreover, the main text of Section 6.5 does not discuss the difference in occurrence frequency for extreme ENSO events between RCP8.5 and RCP2.6 that are explicitly mentioned in SPM B2.7. Only the last sentence of the caption for Figure 6.5 states that "Higher counts of extreme events under the RCP8.5 scenario suggest an increase in the frequency of extreme El Niño under global warming." In fact, it is not very straightforward to extract that conclusion from Figure 6.5. [Government of United States of America]
6944	SPM	15	1	15	4	Are the extreme conditions (presumably temperature ranges, etc.) with respect to the preindustrial baseline or with respect to the changing baseline? It might be worthwhile indicating that on average this will mean El Niño events leading to atmospheric rivers that carry significantly more moisture and so will lead to unprecedented precipitiation and consequent flooding and land slides, erosion, etc. [Government of United States of America]
7482	SPM	15	1	15	4	Since changes in the El Nino-Southern Oscillation (ENSO) due to climate change has been a hot issue, if consensus has been reached, this would mark significant scientific progress since AR5. Thus, mentioning this in the headline would be suggested, for instance in B2. [Government of Japan]
7994	SPM	15	1	15	4	Point B2.7 speaks about the frequency of extreme events. However, difference in likelihood between the two RCPs is not clear (one of the two unquantified increases is smaller, but how much smaller? [European Union]
8208	SPM	15	1	15	4	It would be useful to know the changes in ENSO under other emission scenarios, both RCP2.6 and RCP 4.5 and their respective impacts on the Pacific Ocean. [Government of India]
8446	SPM	15	1	15	4	The projected increase in frequency of extreme El Niño, such as the events of 1983 and 1998, is of great concern for Peru. We salute this mention, yet we would like to have some indication of the potential quantitative increase in probability mentioned in the text. [Government of Peru]
8572	SPM	15	1	15	4	This statement is very important for PSIDs like Kiribati, although Models show smaller increases in frequency for RCP2.6. Scientific studies needs to be invested in the Pacific Ocean in this area, from our experience in the Pacific, ENSO is a major destructive [Government of Kiribati]
708	SPM	15	2	15	2	Here the evidence provided in Chap 6 supports the term "likely" to qualify increased impacts (responses) of ENSO event, regardless of ENSO changes. We believe this disctinction should be made here. [Government of France]
6946	SPM	15	3	15	3	"...experience wetter or DRIER..." is a better choice of wording. [Government of United States of America]
816	SPM	15	6	15	11	We suggest emphasising the probaility of a collapse, rephrasing as :"The AMOC will very likely weaken over the 21st century (high confidence), although a collapse is very unlikely (medium confidence). Nevertheless, a substantial weakening of the AMOC remains a physically plausible scenario." like in chapter 6, p.6-4. [Government of France]
2926	SPM	15	6	15	12	B2.8 states that AMOC collapse is a low risk during the 21st century. However, the underlying report (executive summary, chapter 6) states that "By 2300, an AMOC collapse is as likely as not for high emission pathway and very unlikely for lower ones, highlighting that an AMOC collapse can be avoided in the long term by CO2 mitigation (medium confidence)." The greater risk of collapse under a high emissions pathway over timescales beyond this century is currently not represented in the SPM, suggest the text is edited to highlight this important point. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3726	SPM	15	6	15	12	This is very important information which should be be clearer and part of high level message [Government of Ireland]
3728	SPM	15	6	15	12	Can projected ranges of weakening be provided? [Government of Ireland]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5450	SPM	15	6	15	12	There is a significant finding in relation to the long term risks for an AMOC collapse that is in the ES of Chapter 6. This should be lifted up to the SPM Statement 2.8: "By 2300, an AMOC collapse is as likely as not for high emission pathway and very unlikely for lower ones, highlighting that an AMOC collapse can be avoided in the long term by CO2 mitigation (medium confidence)." [Government of Saint Kitts and Nevis]
6950	SPM	15	6	15	12	B2.8 states that one impact of AMOC weakening would be "more winter storms in Europe". In contrast, Chapter 6 (page 6-47) has text that reads: "The climatic impacts [of weakening AMOC] could be substantial over Europe (Jackson et al., 2015), where an AMOC weakening can lead to high pressure over the British Isles in summer (Haarsma et al., 2015), reminiscent of a negative summer North Atlantic Oscillation (NAO), inducing an increase in precipitation in Northern Europe and a decrease in Southern Europe." The B2.8 summary statement misstates the Chapter 6 text. [Government of United States of America]
6952	SPM	15	6	15	12	Recent published research also suggests a warm-cold dipole in the NW Atlantic Shelf (warm) and sub-polar gyre (cold) in the North Atlantic assoiated with a weakenig AMOC in both observations and a high-resolution global climate model (Caesar et al. 2018, Nature). Might be worth mentioning. [Government of United States of America]
6954	SPM	15	6	15	12	B2.8 should include the the polar regions symbol (snowflake) because impacts will be felt in the Arctic from changes in the AMOC. This key message could include the sea level rise and coast symbol as well. [Government of United States of America]
6956	SPM	15	6	15	12	It is hard to understand how one can have medium confidence in a plausible scenario then say this is a "very unlikely" outcome. This does not seem consistent with the IPCC lexicon, and certainly not if one were to be using a risk-based framework. [Government of United States of America]
7996	SPM	15	6	15	12	The esimated impact of a weakining on the AMOC on high latitudes in the Atlantic and in the Arctic should be mentioned, as the AMOC has a critical impact on sea-ice formation and its subsistence over the summer period. [European Union]
3662	SPM	15	6	15	6	Replace "Atlantic Meridional Overturning Circulation (AMOC)" with "AMOC", since it has already been abbreviated before [Government of Brazil]
710	SPM	15	6	15	7	Please consider adding "under all Representative Concentration Pathways (RCP) scenarios." [Government of France]
3490	SPM	15	6	15	7	Are both "very likely" and "high confidence" needed here? [Government of Sweden]
6948	SPM	15	6	15	7	Add "Based on model simulations, ..." in order to support the stated confidence levels. [Government of United States of America]
8490	SPM	15	6	15	8	As per Ch. 6 Ex Summ, it is useful information to add that the very likely weakening of the AMOC applies to all future GHG emission scenarios. Please clarify whether this statement about plausible collapse of the AMOC is true under all future GHG emission scenarios or over the range of projected warming during hte 21st century. [Government of Canada]
7998	SPM	15	7			the word "plausible" should be replaced by "possible" as plausible implies a judgment on the probability. [European Union]
2896	SPM	15	7	15	7	Suggested edit: 'A collapse in the 21st century is very unlikely…'? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3492	SPM	15	7	15	8	The "plausible" is a difficult concept here, and should be further developed. In what way is a "very unlikely" (quantitative assessment!) still plausible enough? [Government of Sweden]
6958	SPM	15	7	15	8	Suggest replacing "plausible" with "possible". The definition of "plausible" is 'seeming reasonable or probable'. This doesn't seem to apply to a "very unlikely" outcome. [Government of United States of America]
3310	SPM	15	8	15	8	In line 8, what does 'additional' refer to? Additional to what? [Government of Canada]
8192	SPM	15	10	15	10	Atmospheric moisture content is expected to increase during the 21st century (high confidence). The thermodynamic effects of increase in moisture content would lead to increase in the South Asian summer precipitation and can offset potential reductions in South Asian summer rainfall due to weakening of AMOC during the 21st century. Accordingly, confidence level for the reduction in the South Asian summer rainfall due to AMOC weakening may be provided. [Government of India]
2916	SPM	15	10	15	11	Is this true for all tropical cyclones? Chapter 6, section 3 notes that extreme tropical cyclones may have been observed to increase in frequency: ""There is emerging evidence for a number of regional changes in tropical cyclone behaviour such as an increase in annual global proportion of Category 4 or 5 tropical cyclones in recent decades, severe tropical cyclones occurring in the Arabian Sea and making landfall in East and Southeast Asia, increasing in frequency of moderately large US storm surge events since 1923 and the decreasing frequency of severe TCs making landfall in eastern Australia since the late 1800s"" [Government of United Kingdom (of Great Britain and Northern Ireland)]
712	SPM	15	11	15	11	We suggest to replace " ... an increase ..." with " ... an additional increase ..." [Government of France]
5442	SPM	15	14	15	14	It is virtually certain that sea levels will continue to rise. How can it only be 'high confidence'. [Government of Saint Kitts and Nevis]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3730	SPM	15	14	15	15	Can numbers of change of frequency be provided? [Government of Ireland]
3732	SPM	15	14	15	15	Can markedly be quantified? [Government of Ireland]
6960	SPM	15	14	15	15	Provide context for the words 'rare' and 'frequently'. People unfamiliar with the subject matter could interpret "frequently" in wildly different ranges (e.g., it could be 10 days a year or 100 days a year). [Government of United States of America]
6962	SPM	15	14	15	20	How can this statement not indicate the estimated values? Give the numbers. And do it in units that policymakers will understand. Make clear that there is a significant upside risk due to the potential for ice streams to move rapidly, etc. So, basically, the estimate is something like 0.9 meters by 2100 without really counting the potential risk that ice streams could add much more. And give a projection for after that; in fact, it might well be more helpful to give an indication of the potential rise and uncertainties in terms of when an amount is likely to be reached, so something like "1 meter is likely to be reached between XXXX and YYYY, and 2 meters between ZZZZ and AAAA, and if emissions are not rapidly reduced reach 3 meters between BBBB and CCCC." [Government of United States of America]
956	SPM	15	14	15	22	Context is needed for this header statement. To make it more impactful high emission scenario needs to be tied to a temperature and a comparison done with a 1.5 scenario. [Government of Jamaica]
1362	SPM	15	14	15	22	Please provide numbers of projected sea level rise as given in paragraph B3.1. The statement related to AR5 is not necessary in the headline statement and should left to the underlying paragraphs only. [Government of Luxembourg]
2912	SPM	15	14	15	22	The headline B3 statement is missing the key point that sea levels will continue to rise in all scenarios, but will be higher in high emission scenarios and that the gap between RCP2.6/8.5 or 1.5°C/2°C etc widens the further in the future you go, especially past 2100. Suggest this is worked into the statement. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3312	SPM	15	14	15	22	There is no discussion about changes in relative sea level in the future projections. This is a concern because glacial isostatic adjustment can result in changes in RSL that are much different than the global sea level rise projections. For example, in RCP8.5, RSL in Hudson Bay is projected to fall by almost 90 cm by 2100. [Government of Canada]
3734	SPM	15	14	15	22	This could be two bullets with clean text on projected 2100 sea-level rise with a footnote on data in the AR5 [Government of Ireland]
3736	SPM	15	14	15	22	Sea-level rise at various levels of warming should be provided e.g. 1.5C 2c and high temperatures. [Government of Ireland]
6964	SPM	15	14	15	22	KEY ISSUE [STRUCTURE]: This finding is very similar to B9. Recommend combining. Since the report is intended for policymakers concerned about human wellbeing, it seems odd to separate out the physical (B3) then repeat again along with how it impacts humans (B9). Combining the messages/findings into a fewer number that outline the issue-impact-solution would likely be better received by a general audience. [Government of United States of America]
8328	SPM	15	14	15	22	This headline statement is very clearly written. [Government of New Zealand]
8576	SPM	15	14	15	22	This statement (B3) in its entirety is critically important to low lying atoll nations in Small Islands like Kiribati that do not have higher islands to retreat to, because of sea level rise (SLR) [Government of Kiribati]
714	SPM	15	14	15	54	There is no mention of erosion in B3 and sub-messages B3.x, though erosion is discussed several times in Chapter 4. The only mention to erosion is in B9.1. We think that the main findings on the impacts of sea-level rise on coastal erosion should be summarized in B3. [Government of France]
2898	SPM	15	15	15	15	Suggested the following is edited to include current and projected frequencies: '..currently rare (1 in x years) will occure more frequently (1 in y years) by 2050 (high confidence). Without major additional and often costly adaptation efforts…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
2936	SPM	15	15	15	15	Suggest to replace "extreme sea level events that are currently rare will occur frequently by 2050" with "many megacities and small islands will experience current 1-in-a-100 year events annually by 2050." (from rows 41-43, same page). Replacing "extreme" and "rare" with quantified information, and stating who will experience the impacts, makes the statement more meaningful for a policy audience. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4586	SPM	15	15	15	15	adaptation AND 'mitigation 'efforts? [Government of Belgium]
5192	SPM	15	16	15	17	This is not fully correct: projected changes will increase flood exposure; they will lead to increases in risk only if adaptation is not undertaken. Also, the same message is communicated in B9.1, where adaptation is indeed mentioned. Suggest to rephrase here "flood exposure" instead of flood risk, and delete the reference to adaptation. [Government of Germany]
6966	SPM	15	17	15	17	Define the "high emissions scenario" as RCP8.5 everywhere for clarity. At present It is called out only about 50% of the times it is used in the SPM. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
3494	SPM	15	17	15	19	The confidence statement is a bit unclear here. Does medium confidence refer to the fact that projections have been REVISED upwards? (Or that some projections do not lead to such revision)? [Government of Sweden]
3496	SPM	15	17	15	19	The confidence statement conflicts with B3.1 (line 28) where "high confidence" is stated for seemingly the same. [Government of Sweden]
6022	SPM	15	17	15	28	B3 from line 17 to 19, "Under a high emissions scenario, projections of global sea level rise by 2100 have been revised upwards since AR5 due to a projected larger contribution from the Antarctic ice sheet (medium confidence)". However, B3.1 from line 24 to 28, "~ These projections have been revised upwards since AR5 due to a projected larger contribution from the Antarctic sheet (high confidence). " . They indicate same findings but have different confidence level. [Government of Republic of Korea]
8654	SPM	15	17	15	28	The sentences in B3 and B3.1 about the projections of global SLR unde a high emission scenario with regard to confidence on the larger contribution from the Antarctic Ice Sheet does not seem to line up (medium confidence) and (high confidence) [Government of Netherlands]
716	SPM	15	17	15	30	Please check the confidence consistency between B3 and B3.1. B3 : l. 17-19 "Under a high emissions scenario, projections of 18 global sea level rise by 2100 have been revised upwards since AR5 due to a projected larger contribution from the Antarctic ice sheet (medium confidence)" B3.1 l.27-28 : "These projections have been revised upward since AR5 due to a projected larger contribution from the Antarctic ice sheet (high confidence)" [Government of France]
3624	SPM	15	19	15	20	While we appreciate the inclusion of general information on post-2100 sea level rise, we ask the authors to include more specific estimates on the long-term sea level response, like minimum sea level commitments, for example. Given the gravity of sea level impacts in the coming centuries, this time frame has to be covered in more detail in section B3 including subsections despite the existing uncertainties (which will only worsen the picture). [Government of Nauru]
5458	SPM	15	19	15	21	The multi-meter sea level rise commitment strongly depends on the warming scenario. The statement should reflect that. So the last part should read: "Sea level rise will continue beyond 2100. Higher warming scenarios lead to a rapidly increasing commitment of multi-metre sea levle rise rises in the long term." [Government of Saint Kitts and Nevis]
4588	SPM	15	19	15	28	There is contradiction about the confidence inline 19 and 28 .Page 15, line 17-19 point to medium confidence. Page 15, line 27-28 is the same statement but with high confidence. Conflict should be rectified. [Government of Belgium]
5194	SPM	15	19	15	28	In line 19 the Antarctic ice sheet contribution to global sea level rise has "medium confidence", but in line 28 it is stated as "high confidence". Which one is correct? Please clarify. [Government of Germany]
2900	SPM	15	20	15	20	In the long term' is quite vague - perhaps better to use SR1.5 language: 'over centuries to millenia'? [Government of United Kingdom (of Great Britain and Northern Ireland)]
1438	SPM	15	24	15	24	Polar icon? [Government of Denmark]
718	SPM	15	24	15	25	Please consider rephrasing this sentence as it can be confusing. For better readability, we suggest to only mention values "by 2100" and delete "for the period 2081-2100". Please consider using chapter 4 : " GMSL will rise between 0.43 m (0.29–0.59 m, likely range) (RCP2.6) and 0.84 m (0.61–1.10 m, likely range) (RCP8.5) by 2100 (medium confidence) relative to 1986-2005." [Government of France]
4376	SPM	15	24	15	25	There is too much information, making this sentence is not clear. It is not worth to present period 2081-2100 and 2100. It can be: GMSL will rise between 0.43 m (0.29–0.59 m, likely range) (RCP2.6) and 0.84 m (0.61–1.10 m, likely range) (RCP8.5) by 2100 (medium confidence) relative to 1986-2005. (Chapter 4, p.4) [Government of Monaco]
8184	SPM	15	24	15	25	The global mean sea level rise for 2100 may not perhaps be needed. Only the range and mean of sea-level rise for the period 2081-2100 would be useful. [Government of India]
8642	SPM	15	24	15	25	Double set of values is confusing. Why needed? [Government of Netherlands]
2928	SPM	15	24	15	27	Is it necessary to present SLR rise ranges for both 2081-2100 and 2100? It would be clearer for the reader to just present 2100. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2934	SPM	15	24	15	27	This section tells us how much GMSL will rise compared to levels in 1986-2005. This figure might be more understandable to policy makers if we also had figures for how much GMSL rose in X number of years leading up to 1986-2005. While graph (d) in Section A page 4 shows this, some exact numbers, if possible, here would be appreciated. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4152	SPM	15	24	15	27	Please check consistency between text and figure SPM.1. Intentional differences should preferably be explained. [Government of Norway]
6968	SPM	15	24	15	27	Readers could be confused by the reference first to the 2081-2100 period and then to only 2100 when stating the amount rise. How are these different? Are they both needed? It's also not clear how this amount can be related to a range of dates (1986-2005) without explaining what estimate of SLR over that range is being used as a baseline. Same comment for the RCP8.5 values. [Government of United States of America]
1104	SPM	15	24	15	30	Suggest this section should include some indication of the full range of potential sea level rise, not just the likely range, given risk management requires consideration of the full range of possibilities. Failure to communicate this may result in an underestimation of risk and unnecessary growth in future exposure to coastal hazards. The communication of only the central 66% of the potential sea level rise range, limits and may potentially undermine the ability of policy makers to develop policies to address all risks associated with sea level rise. [Government of Australia]
1538	SPM	15	24	15	30	While there is a low probability (or less than 5% probability) that global mean sea levels could rise up to 2m by 2100, we note that there has been a number of published studies (e.g. included in Chapter 4 of the SROCC) which highlight such the low probability but high impact scenarios of sea levels. The SROCC SPM and underlying report, however, do not include such low probability but high impact estimates; and only provide information on the “likely range” of future sea level rise. Sea level rise estimates in the “likely range” only occupy the 17th to 83rd percentile of the distribution curve i.e. the values are within 1 standard deviation on either side of the mean, covering only 66% of the possible sea level rise estimates by 2100. Sea level rise estimates in the “likely range” would, hence, report that sea-level rise is up to 1.1m in 2100. However, we note that if values in the 95th percentile were included (e.g. publications in Chapter 4, SROCC), the estimate could rise to up to 2m. In this regard, we are of the view that the SPM could also discuss and state clearly sea level rise projections beyond the “likely range”. In particular, it would be useful if the SPM IPCC SROCC could reflect: (a) low probability but high impact scenarios; (b) probability density functions for sea level projections by 2100 and beyond. Such information would come in useful for risk assessment studies and adaptation planning, especially for small island developing states, coastal cities and communities. [Government of Singapore]
1552	SPM	15	24	15	30	Chapter 4 executive summary provides the confidence level (medium) for the GMSL rise for RCP 2.6 and RCP8.5. This should be reflected in the SPM B3.1. [Government of Singapore]
3314	SPM	15	24	15	30	B3.1: Confidence in 0.28 m as an upper limit is low (see B3.4 and C3.4). [Government of Canada]
5196	SPM	15	24	15	30	Paragraph B3.1 does not give any indication on possible outcomes beyond the likely range. This is only mentioned for the rate of sea level rise in B3.4, but the total SRL outcomes by 2100 are probably resonating much more with the general public and policy makers. Chapter 4 discusses several (in part deeply uncertain) mechanisms (MISI, MICI, ice-climate feedbacks via meltwater) which would mostly increase rate and absolute SLR by 2100 and beyond. Given the very high importance of such "low probability - high impact" future developments, a statement on the range of outcomes beyond the likely range, and beyond 2100 should be added. However, we feel that this aspect is not adequately captured by the statement within B3.4 line 48-49. Chapter 4 (p. 4-39) states that the "results are discussed in the context of an expert elicitation study (Bamber et al., 2019)" and that (p. 4-40) "the expert elicitation approach suggests considerably higher values for total SLR". Unfortunately there is no attempt to explain this mismatch and an influence on the overall assessment is not visible. We would suggest at least one additional sentence (or even a separate paragraph) on the high end range of Antarctica contribution to SLR, even if such statements will probably given with "low confidence". [Government of Germany]
3664	SPM	15	24	15	52	Replace "global mean sea level" with "GMSL" [Government of Brazil]
5198	SPM	15	25			The reference period is 1986-2005 like in the AR5. Please provide information about how this relates to preindustrial times as given in AR5 SYR footnote 6: "The period 1986–2005 is approximately 0.61 [0.55 to 0.67] °C warmer than 1850–1900.", and similarly for historical SLR of the about 20 cm. [Government of Germany]
722	SPM	15	27	15	28	Please check the confidence consistency between B3 and B3.1. B3 : l. 17-19 "Under a high emissions scenario, projections of 18 global sea level rise by 2100 have been revised upwards since AR5 due to a projected larger contribution from the Antarctic ice sheet (medium confidence)" B3.1 l.27-28 : "These projections have been revised upward since AR5 due to a projected larger contribution from the Antarctic ice sheet (high confidence)" [Government of France]
6970	SPM	15	27	15	28	For accuracy, authors should say that "Sea level rise projections have been revised upwards since AR5" -- not "These projections have been revised upwards" -- because authors are not referring to the the projections provided in this special report. [Government of United States of America]
720	SPM	15	27	15	29	See comment in the caption of Figure SPM.1: 0.28 m seems in contradiction with the Antarctic upper range shown in pannel (f). [Government of France]
6972	SPM	15	28	15	28	Antarctic "ice" sheet "loss". [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7484	SPM	15	28	15	28	Please add “ice” after “Antarctic” [Government of Japan]
724	SPM	15	28	15	29	Please check the accuracy of "0.28m". It seems ok with the text for Antarctica (but not with panel f, figure SPM1), but inconsistent with 4.2.3.1.1. for Greenland, where it is stated that "Based on these modelling studies, the GIS is not expected to contribute more than 20 cm of GMSL rise by 2100 in a RCP8.5 scenario, similar to the upper end of the likely range reported by AR5". It reads like Greenland could contribute to 28 cm of SLR by 2100, while Chapter 4 clearly states 20 cm... [Government of France]
8616	SPM	15	28	15	29	According to panel f the upper end of the likely range under RCP8.5 is 0.36m. This amount of SLR differs from the statement here: 0.28m [Government of Netherlands]
1440	SPM	15	28	15	30	Key finding B3.1 does not capture uncertainty in projection of particularily SLR contribution from Antarctica (Chapter 3 box 8) [Government of Denmark]
6974	SPM	15	28	15	30	Suggest clarifying that RCP8.5 is a high-emissions scenario: "In a high emissions scenario, the Greenland and Antarctic ice sheets could each contribute..." [Government of United States of America]
7590	SPM	15	32	15	33	Background report chapter 6.3 seems to include also RCP4.5 in this context. Why it is not included here? [Government of Finland]
6976	SPM	15	32	15	34	The increase of wave heights and wave-season heights of the Arctic Ocean should be mentioned here. Sections 6.3.1.3 states "The projected reduction in sea-ice extent in the Arctic Ocean (Holland et al., 2006) will increase wave heights and wave-season length (Church et al., 2013)." [Government of United States of America]
6980	SPM	15	32	15	37	Split B3.2 into two points: one for wave height, the other for cyclones. [Government of United States of America]
7574	SPM	15	32	15	37	Increase of wave heights across the Baltic Sea is a conclusion by Morim et al. (2018) shown in their Figure 3a. Although Figure 3a shows consensus for annual mean significant wave height, it does not show it for summer and winter mean significant wave heights, unlike for the Southern Ocean and Tropical East Pacific. This indicates that the confidence level for the Baltic Sea is lower (medium confidence) than for the Southern Ocean and Tropical East Pacific. We suggest changing the text to “Wave heights are projected to increase across the Southern Ocean, tropical eastern Pacific (high confidence) and Baltic Sea (medium confidence), and decrease over the North Atlantic and Mediterranean Sea (high confidence) under RCP8.5.” [Government of Finland]
2920	SPM	15	32	15	38	Is B3.2 talking about average or extreme wave heights? Please clarify. If there is a link between the increase in tropical cyclone intensity and the wave height, this should be stated, otherwise suggest that these two statements are separated. [Government of United Kingdom (of Great Britain and Northern Ireland)]
6978	SPM	15	32	15	53	There needs to be mention of what the likely impacts are of greater wave heights, especially when coupled to higher sea level. Just saying they will increase is not particularly helpful to policymakers. Say what it will mean. For example, there is no mention of erosion processes here due to storms and increased wave action. [Government of United States of America]
6982	SPM	15	33	15	33	Wave heights have been forecasted by numerous authors to decrease in the North Pacific under RCP8.5 (Hemer et al., 2013; Mori et al., 2013; Erikson et al., 2015). [Government of United States of America]
2902	SPM	15	34	15	35	an increase' and 'with greater increases': are there any numbers available regarding cyclone intensity, to better quantify this statement? [Government of United Kingdom (of Great Britain and Northern Ireland)]
8492	SPM	15	34	15	36	This is one example of where the use of 'by 2100' for presenting future climate change is not enlightening for readers. Do the projections support any changes in the intensity of cyclones and associated precipitation rates before the year 2100? [Government of Canada]
6984	SPM	15	34	15	37	It would help to be quantitiative. Give some indication of the percentage changes. Also, there is no mention that higher intensity storms will lead to higher storm surges, which will do further damage due to higher sea levels. With ocean temperatures (and especially some coastal sea temperatures) going up significantly and being higher for extended periods, there is already evidence that tropical cyclone precipitation can be much higher than it was, and this needs to be stated. The statement here is way too mild. [Government of United States of America]
6018	SPM	15	35	15	36	“with greater increases under RCP8.5 in comparison with RCP2.6” can be removed because it seems not to add meaningful information. [Government of Republic of Korea]

SROCC Final Government Distribution Review Comments on the Final Draft Summary for Policymakers						
Comment id	Chapter	From page	From line	To page	To line	Comment
2914	SPM	15	36	15	37	The low confidence statement here is not particularly helpful, as it suggests we have little knowledge about changes in tropical cyclones, and gives no information about regional changes. The following text from section 6.3 of the underlying report could be used to expand this statement from a regional perspective "There is emerging evidence for a number of regional changes in tropical cyclone behaviour such as an increase in annual global proportion of Category 4 or 5 tropical cyclones in recent decades, severe tropical cyclones occurring in the Arabian Sea and making landfall in East and Southeast Asia, increasing in frequency of moderately large US storm surge events since 1923 and the decreasing frequency of severe TCs making landfall in eastern Australia since the late 1800s" [Government of United Kingdom (of Great Britain and Northern Ireland)]
2932	SPM	15	36	15	37	Future changes in tropical cyclone frequency currently seem to be mentioned as an afterthought at the end of a paragraph on wave heights. Suggest it would be very worthwhile to separate out and dedicate a paragraph to the future of tropical cyclones as this is a controversial area but one that promotes a lot of public debate. It's important to have an up to date IPCC statement on this. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5452	SPM	15	36	15	37	Please add the major significant finding that intensity increases already at 2°C from the ES of chapter 6. "An increase in the average intensity of tropical cyclones, and the associated average precipitation rates is projected for a 2°C global temperature rise (medium confidence)" [Government of Saint Kitts and Nevis]
728	SPM	15	39	15	39	It could be useful to also mention "such as... cyclones or mid-latitude storm surges". It seems essential that developed countries do not believe that adverse effects are reserved for the tropics and countries of the South. Chapter 6 is fine. [Government of France]
726	SPM	15	39	15	41	Please reformulate this sentence as it is currently unclear. Please delete "currently"and replace by "have been historically". We also suggest rephrasing as "Due to increasing global mean sea level rise, extreme sea level events, such as surges from tropical cyclones, that have been historically rare [...]". Additionally, please consider replacing "common" by "more frequent" [Government of France]
6986	SPM	15	39	15	41	Include the effect of locally increasing tidal ranges as well as sea level rise on the coasts due to navigational channel deepening and harbor improvements, increasing penetration of tides up rivers, degradation, displacement and disappearance of barrier islands, etc. (There is an absence of papers on these subjects in the reference lists.) [Government of United States of America]
8494	SPM	15	39	15	41	This is another example of where the use of 'by 2100' for presenting future climate change is not enlightening for readers. It would be very useful to add information here about projected changes in extreme sea levels for different periods this century. There is also internal inconsistency within this paragraph because this first sentence says currently rare extreme events will be common by 2100 while the next sentence idenitifes many areas where such events will be experienced annually by 2050. [Government of Canada]
2918	SPM	15	39	15	44	..'will become common by 2100 under all emission scenarios..' - it would be helpful to clarify just how much the frequency of some extreme events is projected to increase. Does this mean 1 in 5 years, or every year for example? [Government of United Kingdom (of Great Britain and Northern Ireland)]
6988	SPM	15	39	15	44	The 100-year event is implied as 'such' events. Becoming annual events by 2050 under all scenarios is very misleading. Perhaps on island coasts and some coastal regions like California where surge is quite small. In these locations (seems the focus of the statement), the 100-year event (tide gauge assessed) are generally not damaging to begin with. [Government of United States of America]
6990	SPM	15	39	15	44	KEY ISSUE [EXTREMES]: The usage of a 100-year event derived from tide gauges does not necessarily equate to flooding and should not be used as a proxy. Where large storm surges occur, the 100-year event does generally equate to moderate/severe flooding. However, in most island and narrow/deep continental shelf regions where storm surge magnitudes are generally small, the 100-year event oftentime does not equate to even minor flooding. Making broad statements based about annual flooding at 2050 is likely biased to places where such events are not impacted and is therefore misleading. The mention of flooding at the end of statement is then not supported. Flood thresholds -- like those of NOAA for minor, moderate, or major flooding -- could be used to support such statements. [Government of United States of America]
6992	SPM	15	39	15	44	If these statements concern projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
8000	SPM	15	39	15	44	Sometimes strong adaptation measures might not be possible at all. Suggestion for changing the sentence: In the absence of strong adaptation where possible, this will lead to increased occurrence of severe flooding (high confidence). {4.2.3, 6.3, Figures SPM.4, SPM.5} [European Union]
6994	SPM	15	40	15	40	Context is provided for rare here (hundred year event), but not "common". Suggest providing a similar definition for common. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
2930	SPM	15	41	15	44	This is an important statement, but suggest it belongs in B9.1 as it is a projected risk to people. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3572	SPM	15	41	15	44	Very important finding, but partial presentation. If "Under all future emissions scenarios" the trends identified are to continue, then they are caused by past emissions. The text should thus read "Under all future emissions scenarios and largely due to past emissions since pre-industrial era, many…" [Government of Brazil]
6996	SPM	15	41	15	44	Do the latter two sentences of this paragraph relate only to the 100-year events described in the first sentence, or to others as well? [Government of United States of America]
8002	SPM	15	41	15	44	B3.3 the statement on annual extreme events for coastal mega-cities and small islands is crucial information and should be presented as one of the main messages of this SPM. [European Union]
8638	SPM	15	41	15	44	Please substitute "such"by "extreme sea level" [Government of Netherlands]
3316	SPM	15	42	15	42	Please clarify what “such events” in this sentence refers to. Is it referring specifically to the 1 in a hundred year event? [Government of Canada]
6998	SPM	15	42	15	42	What is a megacity? Can just "cities" or some other language be used, or can the term be defined? Also, it's not clear what "such events" is referring to exactly. [Government of United States of America]
2904	SPM	15	42	15	43	Suggested edit: 'Under even the lowest emissions scenario, many low-lying megacities and small islands at almost all latitudes will experience such events annually by 2050. In the absence of strang and often costly adaptation…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
5454	SPM	15	43	15	44	The assumptions underlying this 'strong adaptation' need to be clarified. It might be more appropriate to delete this statement here and to reflect on the prospects for adaptation further down in section C. [Government of Saint Kitts and Nevis]
8526	SPM	15	43	15	44	B3.3: Only severe flooding is contemplated? No loss of land mass? [Government of Kiribati]
3318	SPM	15	46			Estimated’; this is not a measure; rather it is a projection. Accordingly, it is recommended that estimated be changed to projected. [Government of Canada]
4234	SPM	15	46	15	46	Is it the rate of GLOBAL MEAN sea level rise that is refered to here? [Government of Norway]
4378	SPM	15	46	15	46	B3.4. Can be just after the B3.1 paragraph, also providing figures on sea-level rise. [Government of Monaco]
7000	SPM	15	46	15	46	It does not make sense to give a range in B3.1, then simply take the mid-range as the estimate for 2100 under RCP8.5 in B3.4. The first-order SPM draft said: "The rate of SLR is estimated to be 19 mm yr-1 under RCP8.5 in 2100." This illustrates the problem with selecting the midrange estimate. [Government of United States of America]
8242	SPM	15	46	15	46	global mean! [Government of Austria]
730	SPM	15	46	15	53	Please consider that the rate of sea level rise could be introduced in B3.1 [Government of France]
2924	SPM	15	46	15	53	The text in B3.4 seems much weaker than the text on this topic in SR1.5. In comparison, SR1.5 states "Marine ice sheet instability in Antarctica and/or irreversible loss of the Greenland ice sheet could result in multi-metre rise in sea level over hundreds to thousands of years. These instabilities could be triggered at around 1.5°C to 2°C of global warming (medium confidence).". This could be supplemented with text from the underlying chapter 2, section 4.2.3.1.2 which states that "the strongly mitigated RCP2.6 scenario prevents catastrophic WAIS collapse over the coming centuries." The low confidence statement in the SPM is inconsistent with the SR1.5 finding and should be amended to accurately reflect SR1.5 and the underlying SROCC chapters. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3498	SPM	15	46	15	53	Information would also be useful to provide from low emission scenarios, not just RCP8.5. The overall bullet as it stands is also a bit repetitive, stating both the magnitude (albeit in different "units") and uncertainty twice. [Government of Sweden]
3738	SPM	15	46	15	53	Is there a way to capture the rate of accelleration of sea-level rise over 20th, 221st and 22nd century perhaps in a figure which is linked to a map of global change? [Government of Ireland]
5200	SPM	15	46	15	53	To improve the logical flow and readability, please move paragraph B3.4 up to line 31 (it should become B3.2), so that it follows after the global mean rise. [Government of Germany]

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5202	SPM	15	46	15	53	B3.4 We appreciate that the authors have included information about the potential disintegration of the WAIS and its contribution to future SLR as well as a reference to post-2100 sea level rise. However we find the representation of both processes here confusing and potentially misleading and would urge the authors to revise this section carefully, providing information first, uncertainty second, and paying close attention to committed effects. More precisely, i) in ln47-48, our reading of material in chapter 4 and 3 is that SLR rates could exceed several cm of SLR post 2100 for high emission scenarios irrespective of whether or not emissions continue after 2100 due to committed change through the GHG forcing during the 21st century - please check and revise; ii) for ln 48-50, we'd expect to be informed first about the risk of ice-shelf loss and ice-sheet-instabilities, and then of the assessment of uncertainty, e.g. sth along the lines of "Loss of ice-shelves and ice sheet instabilities could increase ANT's contribution to SLR to values higher than the likely range (low confidence)". or ""Loss of ice-shelves and ice sheet instabilities could increase ANT's contribution to SLR to values higher than the likely range, however due to uncertainty about timing and extent confidence is low". The time reference here is a little confusing, as the likely range is given for 2100, so "more than the likely range on century and longer time-scales" should maybe be revised to "up to/in 2100 and beyond". It would be useful to clarify whether our understanding is correct and the "values higher than the likely range" refers to 2100, assuming that the rates might also be higher before 2100, if those processes should kick in early and to a large extent? iii) "The few modelling studies available ..." gives an imbalanced view of the state of knowledge presented in Chapters 4 and 3. Please consider to rephrase along the following lines: "evidence from paleo-records and modelling studies indicate multi-meter SLR for high emission scenarios on the timescale of centuries to millennia (medium confidence) iv) lines 51-52 are in direct conflict with the findings from SR1.5, (e.g.3.5.2.5, Figure 3.21, "Instabilities exist for both the Greenland and Antarctic ice sheets, which could result in multi-meter rises in sea level on time scales of century to millennia. There is medium confidence that these instabilities could be triggered at around 1.5°C to 2°C of global warming" - if this is intentional, please provide a standalone section on the topic, indicating the reason for this reassessment, and give a precise reference to the source of the reassessment in the underlying report, as we were not able to locate it within the wealth of information provided in CCBoxes 5 + 8, 4.1 and 4.2.3. If not, please revise the statement to be in line with the findings of SR1.5 and SROCC. Please consider to use a formulation that indicates that instabilities may already be under way, as indicated in CC Box8 and ES3: " There is limited evidence and high agreement that recent Antarctic Ice Sheet mass losses could be irreversible over decades to millennia. Rapid mass loss due to glacier flow acceleration in the Amundsen Sea Embayment of West Antarctica and in Wilkes Land, East Antarctica, may indicate the beginning of Marine Ice Sheet Instability, but observational data are not yet sufficient to determine whether these changes mark the beginning of irreversible retreat", e.g. sth along the following lines: "Recent ANT IS mass loss may indicate the beginning of MISI (low confidence). Estimates of threshold temperature and corresponding rates of GMSL-rise continue to be uncertain, but probability of reaching instabilities rises with higher temperature and is higher in higher emission scenarios". [Government of Germany]
5456	SPM	15	46	15	53	A major short-coming of this report is that it fails to outline the implications of 21st century emissions scenarios for long term sea level rise. There are ample lines of evidence for the risks of multi-meter sea level rise in the longer term, with an estimate of around 2m per degree of warming over the multi-millennial time scale (see e.g. Levermann et al. 2013, or AR5 WG1). It is clear that such estimates are subject to uncertainty. However, it is absolutely clear that the risks are significantly lower for a low emissions scenario compared to a high emission scenario. To quote from Chapter 4.1.2: "However, all studies agree that the difference in GMSL between RCP2.6 and RCP8.5 increases substantially on multicentennial and millennial time-scales (very high confidence). On a millennial time-scale, this difference is about 10 meters in some model simulations, whereas it is only several decimeters at the end of 21st century. The larger the emission scenario the larger the risks associated with SLR as already pointed out in SR1.5. Under RCP8.5 the few available studies indicate a likely range of 2.3–5.4 m (low confidence) in 2300. With strong mitigation efforts (RCP2.6), sea level rise will be kept to a likely range of 0.6–1.1 m (Figure 4.2)." Also, a comparison of only RCP2.6 and RCP8.5 is not sufficient. The rapidly increasing risks of multi-meter sea level rise between 1°C, 1.5°C, 2°C and 2.5°C should be reflected in a separate Bullet 3.5 [Government of Saint Kitts and Nevis]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8656	SPM	15	46	15	53	From policy perspective we would like to ask to elaborate if ice-shelf loss and ice sheet instabilities more likely to occur for RCP 8.5 then for RCP 2.6. In other words is the uncertainty with regards to MISI (marine ice sheet instability) and MICI (marine ice cliff instability) primarily the result of insufficient understanding of ice shelf and ice sheet processes? Or is it coupled to the RCP, if so to which extent? This is especially important for policy makers in the context of the best practices mentioned in C3.4 and C4.4. We think this elaboration would for instance benefit B3.4 and B9.2 [Government of Netherlands]
2922	SPM	15	47	15	47	Is the low confidence associated with the first sentence of B3.4 or with the contribution of Antarctica? Suggest this is clarified. If the latter, the statement that sea level rise could exceed several centimetres per year in the 22nd century in high emission scenarios is important and should be made more prominent, perhaps in the headline statement to illustrate the difference between high and low emission scenarios. [Government of United Kingdom (of Great Britain and Northern Ireland)]
1444	SPM	15	48	15	50	Move to finding B3.1 [Government of Denmark]
1540	SPM	15	48	15	50	SPM would benefit if this sentence is more specific about what "...higher than likely range" means. We suggest to provide some indication about the magnitude and time scale (e.g. by 2100). The use of word "century" is not very clear as well; if it is supposed to be 2100, it might be beneficial to state so more clearly. We also suggest to improve this statement, taking into account the importance of the future sea level rise projections for small islands, coastal cities and communities. If necessary, references can be made to publications cited in Chapter 4. [Government of Singapore]
5204	SPM	15	48	15	50	The sentence "The uncertain timing of future ice-shelf loss...." is confusing. Please rephrase. [Government of Germany]
6024	SPM	15	48	15	52	For Policymakers who is not a specialist in climate change, "ice sheet instabilities" is a difficult term, even if it is correct term in respect of climate change science. To ensure that most policymakers understand this SR, this term needs to be replaced by much better words. [Government of Republic of Korea]
2906	SPM	15	49	15	49	Suggested edit: to values higher than the currently proposed range on...' [Government of United Kingdom (of Great Britain and Northern Ireland)]
1400	SPM	15	50	15	50	Before "The few model studies.." please include the following statement from Chapter 4.1.2 "Beyond 2100, sea level will continue to rise for centuries and will remain elevated for thousands of years (high confidence)." [Government of Denmark]
1106	SPM	15	50	15	51	Suggest that, if models are limited, a confidence level for sea level rise at RCP8.5 be included. [Government of Australia]
8004	SPM	15	50	15	53	The low confidence is likely due to the fact that there are not many studies/papers on these thresholds. This means the thresholds may be even closer then we currently think they are. Suggestion to add : ... sea level rise they can produce, but considering the catastrophic consequences of a possible slipping and sliding of the West Antarctic Ice Sheets would entail, the possibility deserves more attention than the low confidence suggests. [European Union]
1108	SPM	15	51	15	51	Suggest 'low confidence' be italicised. [Government of Australia]
2908	SPM	15	51	15	51	multi-metre rise in sea level for RCP8.5' - what timescale does this relate to, 2300? Please specify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3320	SPM	15	51	15	53	This statement, that there is low confidence in threshold temperatures for ice sheet instabilities and consequent rates of SLR is important as it seems to contradict what the SR1.5 concluded in the SPM para B4.1: "Greenland and/or Antarctic ice sheet instabilities that could result in multi-metre rise in sea level on centennial to millennial time scales may be triggered even if global warming is limited to 1.5°C by 2100 (medium confidence)." If the result of this more recent assessment updates conclusions from the SR1.5, this is important to know and understand. [Government of Canada]
5206	SPM	15	51	15	53	The last sentence in B3.4 seems not very helpful as is. We suggest it could have a larger impact if formulated around probabilities of the tipping point being reached a) already now b) in a 1.5C or well below 2 degree scenario (if that is possible) and beyond; accompanied by the general statement that the probability increases with increasing global temperature levels. Perhaps a text similar to B2.8 ("a plausible scenario") for the possible AMOC collapse could be chosen to express uncertainty. [Government of Germany]
7002	SPM	15	54	15	54	Add back the bullet from the first-order draft SPM about relative sea level rise (B4.4) to this section. It's RSLR that communities and nations will be addressing in the future. [Government of United States of America]
6084	SPM	16	1	19	45	Marine ecosystem is not affected by global warming only. The spread of invasive species is now recognized as one of the greatest threats to the ecological and the economic well being of the planet. These species are causing enormous damage to biodiversity and the valuable natural riches of the earth upon which we depend. Direct and indirect health effects are becoming increasingly serious and the damage to the environment is often irreversible. [Government of Saudi Arabia]

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2946	SPM	16	3	16	19	B4 and B4.1 and B4.2 refer to local and global species loss and loss of global unique biodiversity. If this refers to local and global extinction, it should be stated in such terms, as this would be much easier to understand by policymakers. A useful message to include from section 2.3.3.2 from the underlying report would be "In summary, cryospheric change will alter freshwater communities with increases in local biodiversity, but range shrinkage and extinctions for some species causes regional biodiversity to decrease" [Government of United Kingdom (of Great Britain and Northern Ireland)]
3568	SPM	16	3	16	30	Warming would also result in plant and animal species in the lowlands gradually migrating upwards, putting existing montane populations of plants and animals under increasing stress (Pethiyagoda, 2012b). A lack of knowledge on shifting patterns of plant communities in Sri Lanka warrants in-depth and long term studies focusing on the population dynamics or upward shifting of Sri Lankan plant communities (Pethiyagoda R. 2012. Conservation. In: Horton Plains; Sri Lanka's Cloud-Forest National Park. Colombo: Wildlife Heritage Trust. P. 297–310) [Government of Sri Lanka]
5210	SPM	16	3	16	30	While the B.4 statement gives a clear message for the whole cryosphere in the following paragraphs the Antarctic ecosystems are not referred to. Is there a special reason to leave those out? Changes of seabird colonies, for example, but also occurrence of mosses and lichens, are already observed and also projected to increase. [Government of Germany]
3566	SPM	16	3	16	31	The central highland complex of Sri Lanka is situated in the South-central part of the island and comprises of the Peak Wilderness Protected Area (PWPA), the Horton Plains National Park (HPNP) and the Knuckles Conservation Forest (KCF). These montane forests, where the land rises up to 2500 m (above mean sea level), are home to an extraordinary range of flora and fauna. The region is considered as a super biodiversity hotspot (UNESCO, 2010). Given the number of endemics and threatened species, with their restricted distribution, the Central Highlands Complex including Peak Wilderness Protected Area, Horton Plains National Park and Knuckles Conservation Forest were declared as World Heritage Sites by UNESCO in 2010. The distribution of Sri Lanka's different types of ecosystems depends largely on the spatial variation of rainfall and temperature on the island, as well as on topographic variation and the spatial distribution and diversity of soils (MOE, 2010). Sri Lanka's varied ecosystems provide many services that are of significant economic value and play a crucial role in providing goods and services to meet local and national needs. The subsequent sections featuring specific aspects of biodiversity in forests, freshwater wetlands, coastal and marine systems, and agricultural systems, provide greater detail on the ecosystem services and bio-resources [Government of Sri Lanka]
7004	SPM	16	3	16	4	The change in conditions in the Arctic is having impacts down into mid-latitudes, and so affecting systems there (e.g., the reduced wintertime cooling is allowing pests to propagate and kill vast forest areas). There are also migrating species that reside part of the year in lower latitudes that are being impacted. This notion that what happens in the Arctic (or polar regions generally, for comment applies to Antarctica as well) does not affect what is happening in other latitudes is simply misleading and not fully presenting the findings. [Government of United States of America]
4050	SPM	16	3	16	6	Consider adding sentence on wildfires to B.4, picking up statement in B4.3 that fire is projected to increase for the rest of the century across most tundra and boreal regions. [Government of Norway]
5208	SPM	16	3	16	6	B.4 seems to be very vague. Try to be more specific. Also, medium confidence seems quite low for projections of ecosystem change in some of the world's most sensitive ecosystems (High Mountains, Arctic). [Government of Germany]
7006	SPM	16	3	16	6	KEY ISSUE [CONFIDENCE]: This confidence rating should be higher than medium. Provide confidence levels for 'shifts in species distributions' and 'loss of biodiversity' separately. [Government of United States of America]
7008	SPM	16	3	16	6	If this statement concerns projected changes, specify that they "are projected to be… (medium confidence)" or "have the potential to" rather than "will…". [Government of United States of America]
7010	SPM	16	5	16	5	What does "globally unique biodiversity" mean? Endemic? On what spatial scale? [Government of United States of America]
732	SPM	16	8	16	10	Please check the consistency with A4.1 l.27-28 [Government of France]
7012	SPM	16	8	16	10	If this statement concerns projected changes, specify that they "are projected to be… (high confidence)" or "have the potential to" rather than "will…". [Government of United States of America]
8448	SPM	16	8	16	8	The term "alpine" is biased towards the Alps. We request this be changed to "high-mountain" as an adjective. [Government of Peru]
1576	SPM	16	9	16	11	In relation to the word "alpine", confusion may rise, because it can refer to any mountainous area, or literally to the Alps. Clarification could be needed. [Government of Hungary]
7014	SPM	16	9	16	9	Are these population declines in alpine species applicable to a wide range of taxa? What are the magnitudes and scale of these declines? [Government of United States of America]
2938	SPM	16	11	16	11	Suggested edit: 'Alpine species persistence and the continuation of ecosystem services..' [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7016	SPM	16	11	16	12	If this statement concerns projected changes, specify that they "are projected to be..." or "have the potential to" rather than "will...". Does alpine species' persistence and sustaining ecosystem services also depend on the degree of warming? [Government of United States of America]
7018	SPM	16	11	16	12	Do 'conservation measures and responses' belong in this section? Furthermore, given the extent of such areas, such approaches will likely have beneficial effects in only a small percentage of the areas and species being affected. [Government of United States of America]
8006	SPM	16	12			The need for conservation and adaptation measures to maintain alpine species persistence and services is a key message. It would be good to provide at least an example of such measures in the SPM. [European Union]
7020	SPM	16	14	16	16	Does "High-Arctic" have a different definition than "Arctic"? If so, clarify. If this statement concerns projected changes, specify that they "are projected to be... (high confidence)" or "have the potential to" rather than "will...". [Government of United States of America]
3510	SPM	16	14	16	19	Information would also be useful to provide from low emission scenarios, not just high emission ones (RCP8.5?). [Government of Sweden]
7022	SPM	16	14	16	19	Will there be a net loss in the boreal forest, or will it encroach as well into land currently occupied by the Arctic tundra? [Government of United States of America]
7024	SPM	16	16	16	16	Two-figure precision seems quite a reach here given the many uncertainties. Saying "roughy a quarter to half" would seem more plasuible given uncertainties. [Government of United States of America]
1110	SPM	16	16	16	17	Suggest including a baseline for context. What is the current extent of woody shrubs and tree coverage? This will make the statement more meaningful. [Government of Australia]
8008	SPM	16	16	16	17	As woody plants are part of the tundra already, it would be informative to indicate also the current (and/or preindustrial) cover (e.g., "...expand from x% today to 24-52%"). [European Union]
3322	SPM	16	16	16	19	Confidence levels do not match those given in section 3.4.3.2.1. No confidence level is given for 24-52% expansion by 2050 or for the statement in the last sentence. Unclear how you arrived at the confidence levels in SPM. [Government of Canada]
4112	SPM	16	16	16	19	Consider adding in the reference in 3.4.3.2.1 on decrease of tundra by at least 50 pst. [Government of Norway]
2940	SPM	16	18	16	18	Is the southern edge in the Southern Hemishere? Or the southern edge of boreal forest in the Northern hemisphere? Could you clarify please? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7026	SPM	16	18	16	18	Need to explain what "lower biomass woodland/shrublands" are. Lower than what? [Government of United States of America]
8010	SPM	16	18	16	19	It is unclear why the vegetation replacing the boreal forest would be of "lower biomass", or even be "shrubland" (instead of forest). There is no obvious reason to expect that, the forest types south of the boreal forests have higher productivity and generally higher equilibrium biomass (at maturity of forest). Furhermore, it is unclear why "biomass" is singled out as the only notable descriptor of the vegetation displacing boreal forests, and why not productivity, biodiversity or resilience to increasing impacts (drought, fire, storms). [European Union]
8012	SPM	16	18	16	19	It is unclear why "biomass" is singled out as the only notable descriptor of the vegetation displacing boreal forests, and why not productivity, biodiversity or resilience to increasing impacts (drought, fire, storms). [European Union]
7028	SPM	16	19	16	19	Need to acknowledge the uncertainties and the potential effects of fire and pests, which are causing widespread loss of boreal forests in Alaska. [Government of United States of America]
3326	SPM	16	21	16	21	Permafrost thaw and reductions in snow cover are both projected under future warming scenarios and both will have impacts on hydrology, wildfire, vegetation and wildlife. Suggest rewording to "Projected permafrost thaw and decrease in snow cover will affect....." [Government of Canada]
7030	SPM	16	21	16	21	Replace "or" with "and". [Government of United States of America]
7032	SPM	16	21	16	21	Such changes are happening now; this year, for example, has very high fire extent. [Government of United States of America]
3324	SPM	16	21	16	22	This statement seems to focus on impact of permafrost thaw on wildfire occurrence. However, the information provided in the various sections in Ch. 3 with respect to permafrost and fire focusses on the impact of fire on permafrost (i.e. can lead to ground warming and thawing). It is suggested that you rewrite this sentence to better reflect the impacts that were assessed in the report. [Government of Canada]
7034	SPM	16	21	16	22	If this statement concerns projected changes, specify that they "are projected to be... (medium confidence)" or "have the potential to" rather than "will...". [Government of United States of America]
2948	SPM	16	21	16	30	B4.3 refers to 'fire', while other parts of the report refer to 'wildfire'. If there is a difference, this should be explained, while if they are the same, then a consistent term should be used. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3500	SPM	16	21	16	30	Information would also be useful to provide from low emission scenarios, not just RCP8.5. [Government of Sweden]
4144	SPM	16	21	16	30	Consider adding in B4.3 that there is high conficence that legacy components can be transferred downstream from thawing permafrost etc [Government of Norway]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4146	SPM	16	21	16	30	Consider adding that changes in freshwater cycle can result in changes in timing, duration and magnitude of surface flow events, with consequences for Arctic fish dispersal and migratrion (high confidence) (SROCC 3.4.3.2.3) [Government of Norway]
8014	SPM	16	22	16	22	Insert "patterns" after "wildfire" ("wildfire patterns"). [European Union]
7036	SPM	16	22	16	24	What is the projection of increase in small lake area in 2100 under RCP2.6? [Government of United States of America]
3328	SPM	16	22	16	27	These 2 sentences indicate that thawing of permafrost can lead to wetter ground conditions (lake formation) and also drier conditions. Many readers could see this as contradictory and perhaps you need a qualifying statement here that clarifies things, i.e. depending on drainage characteristics of underlying materials etc. [Government of Canada]
2942	SPM	16	23	16	23	vulnerable to abrupt permafrost thaw' - can abrupt be defined with a timescale? Also does this apply to all scenarios? Please specify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7038	SPM	16	23	16	23	Define "abrupt permafrost thaw". [Government of United States of America]
3330	SPM	16	24	16	24	This statement is linked to section 3.4.2.2 which says that thaw lake areas will increase by 53% and is therefore referring to a subset of lakes not an increase in total lake area which is implied in SPM statement. Not all lakes in the Arctic are thaw lakes. It is suggested that the statement be revised to refer specially to "thaw lake area". Also there is no confidence level given in section 3.4.2.2 for the magnitude of increase in thaw lake area so unclear where medium confidence comes from. [Government of Canada]
7040	SPM	16	25	16	31	No mention of erosion or carbon runoff from degrading permafrost. [Government of United States of America]
7042	SPM	16	26	16	26	What type of "consequences"? To be useful, there needs to be an indication of direction and amount. [Government of United States of America]
2944	SPM	16	27	16	27	Fire is projected to increase' - is it possible to estimate by how much, and whether projections vary under high and low emissions scenarios? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7044	SPM	16	27	16	27	By roughly how much is fire projected to increase? Based on changes with present warming, the increase is likely to be many tens of percent and more. [Government of United States of America]
7046	SPM	16	27	16	29	Is future fire intensity and fequency also projected to be affected by wildfire management practices? [Government of United States of America]
1112	SPM	16	27	16	30	Suggest clarification: has the potential of tundra fires been modelled for significantly increasing the CO2 emissions, particularly compounding if peat/bogs ignite and release their carbon potential? [Government of Australia]
3502	SPM	16	28	16	29	Which interactions and in what way? [Government of Sweden]
4186	SPM	16	31	16	31	Possible to include a statement on changes in growth season? [Government of Norway]
2950	SPM	16	32	16	40	B5 uses the terms 'biomass production', 'standing stocks' and 'community structure', which may not be understood by non-experts - please define/clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2952	SPM	16	32	16	40	It is currently unclear what the main message of B5 is intended to be. It should be simplified to something that clearly states that ocean biodiversity and populations will decrease overall, but with regional variations, with the highest impact projected for the tropics. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5212	SPM	16	32	16	40	B5. Headline Statement: Based on what is reported in the subsections of B5 and Figure SPM.3, it seems to us that the key message here may be the massive redistributions and shifts of ocean ecosystems and productivity, rather than a total aggregate decline, that has only medium confidence. We'd encourage the authors to revise B5 to be more concise and highlight the most relevant findings rather than providing a somewhat generic list of effects. [Government of Germany]
8578	SPM	16	32	16	40	This statement (B4) is important statement for Kiribati. The poleward shifts is critical for those countries that heavily rely on fisheries as major economy [Government of Kiribati]
5214	SPM	16	32	16	47	Decrease of catch potential due to climate change is assessed as “very likely” in B5.1 but as “medium confidence” in headline statement B5, which seems contradictory. To us, “medium confidence” seems more appropriate, because to assess the influence of temperature rise on fish abundance and catch potential we need to involve temperature changes in models of population dynamics, which has been shown to be unsuccessful with only few exceptions (i.e., it is very hard to separate temperature from fishery influence in those statistical models). Please clarify and revise. [Government of Germany]
7048	SPM	16	32	16	47	There is quite a bit of uncertainty in primary productivity projections under climate change; yet, there is even more uncertainty in fisheries catch both regionally and globally. "Low confidence" should be associated with any projections in fisheries catch (as opposed to medium confidence). This "low confidence" in fisheries catch is discussed on pages 18-19. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5216	SPM	16	32	17	23	The assessment in this section B5 appears clear and well-balanced. It is however not entirely evident why cold-water corals are highlighted in a separate section. For brevity and conciseness, the authors may consider to integrate the conclusions in B5.4 into B6.1 or B6.4. Else, please add an explanation of the importance of cold water coral ecosystems and why they are included with marine rather than coastal ecosystems, as this is not evident for non-experts. [Government of Germany]
8016	SPM	16	32	17	23	All section B.5: Impacts on regulating and cultural ecosystem services are totally missing and should be included; only provisioning services and ecosystem functioning are mentioned. Same is true for the following sections B6-B9, except B6.4 [European Union]
8646	SPM	16	33	16	34	Would be good tot add some figures on level of decreases ; unclear why medium level of confidence as B5.1 only indicates high confidence and very likely ranges. [Government of Netherlands]
3740	SPM	16	33	16	37	Use projected rather than will. [Government of Ireland]
7050	SPM	16	33	16	40	If these statements concerns projected changes, specify that they "are projected to be...(confidence/likelihood)" or "have the potential to" rather than "will...". [Government of United States of America]
5218	SPM	16	35	16	39	"The rate and magnitude of decline will be highest in the tropics (high confidence), where mixed responses will occur in polar region". Moreover, it says "... productivity... will be compromised by... and sea ice reduction". While we agree that expected responses will be mixed in the polar regions, sea ice reduction is expected to first enhance productivity in the Arctic ocean (as it is correctly stated under B5.2). the text may need to be more carefully phrased here to avoid an impression of being biased towards reporting negative outcomes. [Government of Germany]
3332	SPM	16	36	16	36	Unclear what the 'decline' here is referring to. Only to the fisheries catch potential (from the previous sentence) or to rates of biomass production more generally (first sentence)? [Government of Canada]
4198	SPM	16	36	16	37	On .." whereas a mixed response will occur in the polar regions." -- we feel that the term "response" could be misunderstood. Is it "impact" that is meant here? Also consider picking up key points from the sentence in B5.3, line 6-9 to explain the mixed response. [Government of Norway]
7052	SPM	16	38	16	38	Remove "and" before "oxygen loss". [Government of United States of America]
3504	SPM	16	39	16	39	The meaning of "and regional conditions" is unclear. Please clarify. [Government of Sweden]
7054	SPM	16	42	16	42	"alter" in which direction and by about how much? [Government of United States of America]
7056	SPM	16	42	16	43	Is it 'changes' in NPP or 'declines' here? [Government of United States of America]
3334	SPM	16	42	16	47	B5.1: The statement "maximum catch potential of fisheries are projected to decrease by 15.0±5.9% (very likely range) and 16.2% to 25.5% by 2100 under RCP8.5" doesn't really make sense. Please clarify that the two ranges refer too. [Government of Canada]
5220	SPM	16	42	16	47	B5.1 One could doubt that global aggregate numbers are the best way to present this in the SPM, since as shown in Fig SPM3, differences between tropics and high latitude changes are very large. A regional specific statement would also help to link to SPM B8.1 and explain consequences for fisheries and dependent communities. [Government of Germany]
5460	SPM	16	42	16	47	The reductions in catch potential are not globally uniform, but tropical regions are particularly affected. Please state that reductions in tropical regions for both production and catch potential are projected to be more than twice the global average. [Government of Saint Kitts and Nevis]
8528	SPM	16	42	16	47	B5.1: "the maximum catch potential of fisheries are projected to decrease by 15.0±5.9% (very likely range) and 16.2% to 25.5% by 2100 under RCP8.5." really important statement for countries (such as Kiribati) that depend so much on fisheries as a mean source of food and livelihood. [Government of Kiribati]
734	SPM	16	43	16	43	"especially in tropical regions": While the decrease in tropical regions is expected to be much larger than elsewhere, a specific paragraph or sentence should provide the main expected pattern regarding those regions (in term ou biomass and potential catches). [Government of France]
136	SPM	16	44	16	46	The following wording is suggested in order to enhance clarity: The global-scale biomass of marine animals across the foodweb is projected to decrease by 15.0±5.9% (very likely range) and the maximum catch potential for fisheries by 16.2% to 25.5% by 2100 under RCP8.5. [Government of Austria]
1114	SPM	16	44	16	46	Suggest clarification: does this statement contradict the statement on p14 lines 32-34. [Government of Australia]
6026	SPM	16	44	16	46	"~ are projected to decrease by 15.0±5.9% (very likely range) ~" is relative to which period? [Government of Republic of Korea]
7058	SPM	16	44	16	46	"15.0±5.9% (very likely range) and 16.2% to 25.5% by 2100" -- Specify/clarify which statistics match with which variable. [Government of United States of America]
7060	SPM	16	44	16	46	What are the projected changes for RCP2.6? [Government of United States of America]
7486	SPM	16	44	16	46	In the main chapter, the reductions by 16.2% to 25.5% are projected by "2095" under RCP 8.5 for the global-scale biomass of marine animals across the food web and the maximum catch potential of fisheries. However, we would like to know whether the projected reductions would really be the same through 2100, as indicated in the SPM. [Government of Japan]

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8018	SPM	16	44	16	46	“respectively” should be used to attribute the percentages provided to first, biomass, and second, maximum catch potential (if that is what the numbers indicate). [European Union]
4224	SPM	16	44	16	47	In earlier assessments, distincions have been made between impact on productivity and catch potential at high and low latitudes. These differences are also apparent from Figure SPM.3 a-c. These differrences should be described here, related to RCP 2.6 and RCP 8.5, and if possible, quantified. Impacts on catch potential could be considered moved from "projected risks to ecosystems" to "projected risks for people" on page 19-21. [Government of Norway]
5222	SPM	16	45			Please provide confidence levels for these statements. Is it appropriate to provide decimal digits that imply at least high confidence in these figures? [Government of Germany]
736	SPM	16	45	16	45	Adding "respectively before "by 2100" might clarify the meaning of the sentence. [Government of France]
3506	SPM	16	45	16	45	Might be useful to express the ranges in the same way (x+/-y or XX-YY). [Government of Sweden]
4380	SPM	16	45	16	45	This doesn't read well. Under which scenario is projected the "decrease by 15.0" [Government of Monaco]
7062	SPM	16	45	16	45	"...16.2% to 25.5% RESPECTIVELY by 2100..." [Government of United States of America]
7064	SPM	16	45	16	45	This is presumably some model result and associating "very likely" with one of the numbers seems really a stretch given various limits and uncertainties. [Government of United States of America]
7066	SPM	16	46	16	47	If this statement concerns projected changes, specify that they "are projected to be... (very likely)" or "have the potential to" rather than "will...". [Government of United States of America]
4382	SPM	16	49	16	50	This sentence should be at the beginning of B5.1. It introduces the cause of ocean net primary production reduction. [Government of Monaco]
7068	SPM	16	49	16	50	What are the projected changes for RCP2.6? [Government of United States of America]
3336	SPM	16	49	16	53	RCP4.5 appears to be neglected throughout the document and then appears out of the blue in B5.2. [Government of Canada]
740	SPM	16	49	17	15	Please revise B5.2 and B5.3 to make these paragraphs consistent, and closer to current knowledge. As it is now, B5.2 and B5.3 are overlapping in terms of sea ice zone productivity, B5.2 claiming that sea ice NPP will increase whereas B5.3 is saying it may decrease. Please do not state about an increase or a decrease in Arctic NPP, because models do not agree on future changes in Arctic Net Primary Production (Vancoppenolle et al, Global Biogeochemical Cycles, 2013). We suggest to replace by « The simulated light-driven increase in NPP in the Arctic is uncertain, because of large uncertainties on nutrient supply», which would be more faithful to current knowledge. Otherwise, « low confidence » would be more appropriate in terms of an increase in Arctic NPP because of uncertainties in nutrient supply (based on Chapter 5 figure 5.5 it is unclear that stratification will increase in the Arctic, so the link to decreased nutrient upwelling is even more tenuous). As it is now, B5.3 is not as concise as other paragraphs and it misses the big picture in terms of NPP. The focus on under-ice blooms probably misses the key point that large changes in ice-associated biological activity are expected, below, within and in the vicinity of sea ice. Yet these are poorly understood because of low understanding and large uncertainties on nutrient supply. Furthermore, we are currently not sure that under-ice blooms are more likely with less sea ice: we do not really understand them. Lowry et al (DSR-2014) find that under-ice blooms have been prevalent in Chukchi Sea for more than a decade prior to their discovery in 2011. Please rephrase this paragraph. Please check that the correct feature is depicted in the chapters. [Government of France]
3340	SPM	16	49	17	16	Conflict between B5.2 and B5.3: It seems we have medium confidence in an increase or decrease in primary production in the Arctic (page 16, line 51; page 17, line 11-12), which is confusing but likely a result of difficulties in prediction of primary production. [Government of Canada]
738	SPM	16	49	17	2	1. This paragraph B5.2 on NPP could be moved above paragraph B5.1 which relates on the consequences of NPP changes on biomass and potential catches. 2. Please check the consistency with paragraph B.2.4 as they may be partially redundant (and for some expected values sometime contradictory). [Government of France]
3338	SPM	16	49	17	2	The confidence in projected future increases in Arctic Ocean primary production is also overstated. That is, the summary assigns ‘medium confidence’ to that assertion, but the paragraph bridging pages 3-30-31 (section 3.2.3.1.1) makes it very clear that there is little consensus on which way future primary production will go in the Arctic Ocean. The subsequent statement in the Summary for Policy Makers, specifically about projections for Arctic Ocean primary production (i.e., B5.3) is much more accurate. [Government of Canada]

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3742	SPM	16	49	17	2	This is quite obsecure and the verbal construction is complex [Government of Ireland]
7070	SPM	16	49	17	2	If these statements concern projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
7072	SPM	16	50	16	50	Is this total marine primary productivity or just that of the tropical ocean? Maybe both numbers should be stated here for perspective. [Government of United States of America]
5224	SPM	16	50	16	52	The finding that "warming, stratification and sea ice loss will increase primary production in the Arctic (medium confidence)" is correctly phrased and we agree with the level of confidence provided. This conclusion is also based on findings that phytoplankton has the capacities to compensate for ocean acidification, which is discussed in the underlying chapter 3 of SROCC. However, there is an error in one related statement in the underlying report on p 3-173, which should be corrected: Where it reads "Phytoplankton may have the capacity to compensate for ocean acidification under a range of temperatures and pH values (Hoppe et al. 2018)", it should read ".... to compensate for ocean acidification under a range of temperatures and light levels (Hoppe et al. 2018)". Please revise. [Government of Germany]
7074	SPM	16	50	16	52	Do these estimates account for ocean acidification? Also, it needs to be said that these results are assuming there is essentially no harvesting of fish going on in the region, as this is the situation now. Quite likely, as is the case elsewhere in the world, any significant harvesting would have significant impacts, and this needs to be said so findings do not get taken out of context. [Government of United States of America]
3342	SPM	16	51	17	12	Statements on page 16, line 51 and page 17, line 11-12: Neither of these statements mentions the role that winds might play in the nutrient balance of Arctic continental shelves via upwelling/down welling now that the sea ice retreats beyond the shelf break in summer. See: 3.2.1-3.2.4 [Government of Canada]
2954	SPM	16	52	16	53	The language here does not appear to relfect an important message in the underlying chapter, that 'alterations in the sinking flux' is actually a net decrease (ref Chapter 5, pg 7) " Globally, the sinking flux of organic matter from the upper ocean into the ocean interior is very likely to decrease..." - suggest this is edited to reflect this. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3344	SPM	16	52	17	2	The relevance of this result for policymakers is questionable. Unless additional information is added to explain why policymakers need to know about changes in deep sea biomass, we suggest this detail could be left out of the SPM. [Government of Canada]
1448	SPM	17	1	17	1	First time the SPM mentions RCP 4.5 [Government of Denmark]
2960	SPM	17	1	17	1	under RCP8.5' - by how much, compared with RCP2.6 and 4.5? Please specify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3666	SPM	17	1	17	1	Replace "3000-6000m" with "3000-6000 m" [Government of Brazil]
4384	SPM	17	1	17	1	It is the first time that this RCP is introduced. Better just compare with RCP2.6. [Government of Monaco]
7076	SPM	17	1	17	1	RCP4.5 is not mentioned anywhere else in the SPM. [Government of United States of America]
2958	SPM	17	1	17	2	Could you elaborate on what this point means for deep sea ecosystems beyond the effect on cold-water corals in B5.4? For example, the executive summary in Chapter (page 8) states that: " The increase in climatic hazards beyond thresholds of tolerance of deep-sea organisms will increase the risk of loss of biodiversity and impacts on functioning of deep water column and seafloor that is important to support ecosystem services, such as carbon sequestration (medium confidence). {5.2.4}" Also, possibly a very difficult question to answer but presumably this change in OM flux from the surface will lead to changes in the marine carbon cycle and CO2 storage at depth - is it possible to comment on this (unless the literature isn't there)? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4052	SPM	17	4	17	15	The descriptions of projected impacts on polar ecosystem could be related more explicitly to RCPs 2.6 and RCP8.5. [Government of Norway]
7080	SPM	17	4	17	15	Why is this statement not the lead statement on impacts? The chapeau on ecosystems needs to be clarified and expanded, emphasizing B5.3. [Government of United States of America]
8020	SPM	17	4	17	15	The two effects indicated in point B5.3 seem incompatible; an increase of blooms and microalgae cannot happen concidential with a decrease in primary production. Either there is a geographical difference in the location of the events or there is a temporal mis-match, which would need to be explained. In chapter 3.2.3, the spatial heterogeneity of expected impacts on polar marine ecosystems is largely mentioned. In particular, the reduction of NPP due to enhanced stratification is expected to happen in the open central Arctic, far away from the coasts/ice regions. So some remarks should be included here, otherwise the message is not understandable. [European Union]
7078	SPM	17	4	17	6	Provide some illustrative examples of direct and indirect effects. [Government of United States of America]
138	SPM	17	6	17	6	What is the definition of "fitness" in that context? [Government of Austria]

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Comment id	Chapter	From page	From line	To page	To line	Comment
742	SPM	17	6	17	6	Please delete "ecologically-important". "The range of Arctic marine species [...]" would be enough [Government of France]
4590	SPM	17	6	17	6	Fitness' ? Or resilience to adapt to climate change. Please clarify. [Government of Belgium]
4592	SPM	17	7	16	7	Why 'mammals, birds and fish' are mentioned as 'including ecologically important', and not other taxa. We must be careful not creating wrong argumentation for conservation priorities [Government of Belgium]
3346	SPM	17	9	17	12	Suggest this level of detail could be left out of the SPM. If kept in, additional information would be needed to explain this properly. Booms should be blooms we presume. Are these harmful or beneficial blooms? And if multi-year ice is declining, then why are under-ice blooms expected to become more intense? Presumably because these occur on thinner first year ice.....too much left to readers to figure out on their own. [Government of Canada]
7082	SPM	17	9	17	14	If these statements concern projected changes, specify that they "are projected to be... (medium confidence)" or "have the potential to" rather than "will...". [Government of United States of America]
744	SPM	17	10	17	10	If "growth of microalgae" refers to chap 3 p.3-31, please add "within the ice due to increased light availability (medium confidence)." [Government of France]
1116	SPM	17	10	17	10	Suggest correction: "blooms" instead of "booms"? [Government of Australia]
2962	SPM	17	10	17	10	blooms' - typo here [Government of United Kingdom (of Great Britain and Northern Ireland)]
3554	SPM	17	10	17	10	Change "booms" to "blooms". [Government of Sweden]
5226	SPM	17	10	17	10	Typo: „booms“ should be „blooms“ [Government of Germany]
7084	SPM	17	10	17	10	Change "booms" to "blooms". [Government of United States of America]
8330	SPM	17	10	17	10	Change "booms" to "blooms" [Government of New Zealand]
2970	SPM	17	11	17	12	The conclusion on reduction in rates in primary production in the future in the Arctic here, appears to contradict an earlier statement (B5.2, pg 16, line 51) that net primary production in the Arctic will increase in the future. Rewording or clarification should be provided, i.e. does 'future' mean mid or end 21st century? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7086	SPM	17	11	17	12	This contrasts with the statement on page 16, line 51. Ensure consistency. [Government of United States of America]
7088	SPM	17	12	17	13	This is the only use of the word "whole" in relation to ecosystems. What does it specify here? [Government of United States of America]
7090	SPM	17	13	17	14	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
7092	SPM	17	17	17	19	Place comma before "and exacerbate...". [Government of United States of America]
7094	SPM	17	17	17	20	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
2968	SPM	17	17	17	23	The language on corals is is particularly vague and weak when compared to SR1.5. The executive summary of chapter 5 in this report states "Almost all coral reefs will degrade from their current state, even if global warming remains below 2^{O}C (very high confidence), and the remaining shallow coral reef communities will differ in species composition and diversity from present reefs (very high confidence)." and "coral reefs (very high confidence) will face high to very high risk already at temperatures 1.5 °C of global warming (high confidence)." These messages should be prominently stated in the SPM, or the message from SR1.5 could be used ("Coral reefs, for example, are projected to decline by a further 70–90% at 1.5°C (high confidence) with larger losses (>99%) at 2ºC (very high confidence)." [Government of United Kingdom (of Great Britain and Northern Ireland)]
3508	SPM	17	17	17	23	Information would also be useful to provide from low emission scenarios, not just RCP8.5. [Government of Sweden]
5462	SPM	17	17	17	23	Why is a specific statement on cold water corals warranted here? Please consider moving to B6 and/or add risks for warm water coral systems. [Government of Saint Kitts and Nevis]
3348	SPM	17	17	17	24	This is a very difficult para to read and understand. The first sentence is very long and technical (e.g. what is bio erosion? e.g. how does decrease in flux of organic C to the deep ocean affect cold-water coral communities?). Is this a matter of food supply and therefore linked to the last sentence in this para? If so, this should be made more explicit by using similar terms in both sentence 1 and sentence 3. Add text to explain that cold water corals are deep sea corals. [Government of Canada]
8022	SPM	17	17	17	24	The SR1.5 statement on coral is much simpler to understand ("Coral reefs are projected to decline by a further 70–90% at 1.5°C (high confidence) with larger losses (>99%) at 2°C (very high confidence)"). Perhaps take that statement as a starting point and explain the findings of this report go further. See also our comment on B6 and B6.4. It makes more sense to place messages on specific themes together. [European Union]

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2964	SPM	17	19	17	19	non-living components of cold-water coral' - does this mean the structure on which living organisms thrive, to produce healthy coral reefs? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4386	SPM	17	20	17	20	"Particularly vulnerable" - Box 5.2, to which this text is linked, mentions a "low vulneralbilitiy" of cold- water corals to future more acidic conditions, this goes in part against this text. Nowhere in this Box 5.2 it is mentioned that CWCs would be particularly vulnerable. It is simply mentioned that the biotopes would be "projected to decrease with multiple climatic hazards". [Government of Monaco]
746	SPM	17	20	17	21	As it is, this expression is true by definition of the tolerance. If possible, we suggest to give an example of temperature and oxygen thresholds for one or several coral species. This would convey a much stronger message. [Government of France]
7096	SPM	17	20	17	21	"... corals will be particularly vulnerable where and when temperature and oxygen conditions are both outside the species' tolerances ..." is not informative. The important question is where and when that will happen. [Government of United States of America]
1218	SPM	17	21	17	23	The finding in the sentence “Reduced particulate food supply is projected to be experienced by 95% of cold-water coral ecosystems by 2100 under RCP8.5 relative to the present, leading to a loss in their biomass (medium confidence).” is assigned with “medium confidence”, while Box 5.2 of Chapter 5 on page 55 of the underlying report states that “Under RCP 8.5, 95% ±2% (95% CI) of coral-water coral habitats are projected to experience animal biomass decline (-8.6% ± 2.0%) globally by 2091-2100 relative to 2006-2015, driven by a projected 21% ±9% drop in POC flux”, in which no confidence level is given. A check for alignment is suggested to be made. [Government of China]
2956	SPM	17	21	17	23	"Reduced particulate food supply is projected to be experienced by 95% of cold-water coral ecosystems by 2100 under RCP8.5 relative to the present, leading to a loss in their biomass". Could this be replaced with "Under RCP8.5, 95% of cold-water coral ecosystems will have shrunk by 2100 due to reduced food supply." for a clearer message? [Government of United Kingdom (of Great Britain and Northern Ireland)]
2966	SPM	17	22	17	23	Suggest to also include: 'and y% by 2100 under RCP2.6.' Also could the definition of 'present' be provided - range of years, or particular year? [Government of United Kingdom (of Great Britain and Northern Ireland)]
3744	SPM	17	23	17	24	Are projections of possible future enhanced release of CO2 from oceans availble for this section? [Government of Ireland]
8420	SPM	17	25	17	25	Add the following: 'B5.5 Anthropogenic changes in Eastern Boundary Upwelling Ecosystems (EBUS) will emerge primarily in the second half of the 21st century (medium confidence).EBUS will be impacted by climate change in different ways, with strong regional variability with consequences for fisheries, recreation and climate regulation (medium confidence) {Box 5.3}' [Government of Peru]
2974	SPM	18	0	18	0	SPM3(d): The Reasons for Concern figures in both AR5 and SR1.5 include consideration of adaptation/limits to adaptation in their assessment of risk for each system, but this one doesn't - it would be good to do this to retain consistency and ease of comparison across the reports. [Government of United Kingdom (of Great Britain and Northern Ireland)]
2976	SPM	18	0	18	0	SPM3(a - c): The differing time periods across these three figures is confusing and misleading. Could they be harmonised so we can reliably compare between the three? [Government of United Kingdom (of Great Britain and Northern Ireland)]
1364	SPM	18	0			Figure SPM.3: The shaded areas are very difficult to discern. Please make them more easily visible. Also indicate them in the legend of the graphics. [Government of Luxembourg]
1366	SPM	18	0			Figure SPM.3: In the lower panel for risk to ocean systems, please also add a line for 1.5°C of GMST. [Government of Luxembourg]
7564	SPM	18	0			Figure SPM.3 d) needs clarification. It would be useful to separate it from figures a)-c) and give a more in depth explanation especially related to what is meant with "impacts" or "risks" and what means "transition". [Government of Finland]
8496	SPM	18	0			Recommend splitting this figure into two, with the top three panels as one Figure and then the Burning Embers panel as a separate figure. This would allow more space to adequately explain the Burning embers panel. Colour scheme should be revised to match that of SRCCL SPM (e.g.g purple colour for very high risk is not apparent in this version), and other changes made to bring consistency between such figures here with the approved version in the SRCCL SPM. [Government of Canada]
4388	SPM	18	0	18		For clarity, adding these information in title, before each figure: eg. a) Changes in net primary proction,2081-2100 relative to 1986-2005. [Government of Monaco]
4390	SPM	18	0	18		d) for coral, This is based on IPCC SR1.5, which has been contested. [Government of Monaco]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8024	SPM	18	0	18		Figure SPM3 is helpful overall. Some suggestions for improvement. i) link the RFC row (panel d) more closely to the text. The RFC diagram is useful, but its concepts are not always the same as those used in the SPM text. ii) the fact that the RFCs do not consider adaptation should be stated more prominently (e.g. as a subtitle). Presumably this is relevant only to panel d? Could the Figure be placed later? Specifically after Section B6.1, since this is where kelp forests, rocky shores etc. are introduced for the first time. [European Union]
7538	SPM	18	0	19		Figure SPM.3 caption claims that in panel d) global mean sea surface temperatures relative to pre-industrial level is given in right axis, please, revise. [Government of Finland]
7576	SPM	18	0	19		Figure SPM.3 uses term “Confidence level for transition”. This has not been explained in the figure caption which would help the reader unfamiliar with the term. [Government of Finland]
5228	SPM	18	1			It could be expected that Figure SPM.3 showing the "Projected changes and risks for ocean ecosystems" will be referred to quite often when potential reasons for future management will be discussed. Unfortunately, the chosen graphs show only "primary production", "total animal biomass" and "fisheries catch potential" in geographical distribution as well as "risks to ocean systems" in general. A visualization of ecosystem changes like habitat loss or altering species composition/community structure is missing although it is addressed in B5.1, B5.3 and B5.4 and in B6 paragraphs. We would prefer those components to be shown in Figure SPM.3 instead of animal biomass to highlight the problem of ecosystem change. [Government of Germany]
5230	SPM	18	1			Figure SMP.3 (c) seems to imply that losses in catch potential in the tropical region may be balanced by gains in the Arctic. It would be better to give changes in catches in tons. [Government of Germany]
5232	SPM	18	1			Figure SMP.3 (d) the use of a colour scale with discrete colours would improve the clarity of the figure [Government of Germany]
5234	SPM	18	1			SPM.3 This is a helpful visual to show the changes and risks in marine ecosystems. We have a few comments for improvement: i) For all three graphs a-c, the projection could lead to the misperception that the areas near the poles with positive change in mass/NPP are of similar magnitude to the tropic areas with negative effects. Also, the percentage change does not allow for an assessment of the size of the effect in absolute terms. It may be helpful to include two additional graphs at the side that display 1) the total area affected by pos/neg change, or if useful disaggregated by 10%-intervals; and 2) an aggregation of absolute changes per latitude band; this may also be helpful to further clarify the difference between RCP2.6 and RCP8.5; ii) for panel C, it should be made more clear that this panel has a very different base: mid-century to 2000, and restricted to shelf-ecosystems; we'd encourage the authors to make this clear in the headline, e.g. by adding "in shelf seas between 2000 and 2050", or the precise periods, iii) a similar edit should also be done in the headline for panel a and b, e.g. "recent past compared to end of century"; iv) for panel d, we'd strongly advice against the double axis with SST and GMST. As we have said before, the RFC is an iconic figure and changes to the framework should be very carefully reasoned; the double axis can also lead to confusion, as SST rises more slowly than GMST, which may give the impression that impacts happen later than they actually do, unless very close attention is paid to which axis means what (provided that people don't cut the 2nd axis from the picture to begin with.) GMST is the generally accepted reference for risk levels, and the introduction of a different metric, while scientifically sound, would be difficult to communicate. We'd therefore suggest to keep the GMST axis only, and add an extra small and separate scale to the legend that shows the two metrics side by side, if authors think that this is a necessary information in the context of this graph. Building on our suggestion in the comment to SPM.1 panel j (heatwaves), one could also think of inserting a combined version of SPM.1 panel c + i here, in addition to j, assuming that the impacts shown are mainly driven by changes in Temperature. [Government of Germany]
5236	SPM	18	1			Please consider to change title to d) Risk to coastal and marine systems [Government of Germany]
5238	SPM	18	1			The Figure SPM.3 is showing net primary production, total animal biomass and maximum fisheries catch potential, all of which show district difference between RCP2.6 and 8.5. In the respective text, mostly declining trends are discussed for the low to mid latitudes, and critical readers may see the high latitudes with often increasing trends underrepresented in the SPM. While we do not share this point of view, we see a risk for rather blunt misinterpretations such as overall there not being a clear change in these important measures, e.g. productivity is just differently distributed in the future. This could be circumvented if the authors considered the area of change as well. The regions with declining trends clearly cover a much larger area than those with potential increases, but this is not readily visible from the Mercator projection-type of map used here. [Government of Germany]
1118	SPM	18	1	18	1	Suggest clarification on what the 'handlebars' indicate (Figure D), i.e. why are there two on some and three on others, does this relate to RCP2.6, 4.5 and 8.5? [Government of Australia]

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3350	SPM	18	1	18	1	It is not at all clear, and may be a source of confusion, why different color scales are used in the top three panels of this figure, given that they all show % change over the same -50 to +50 range. Also, the way the color bar legend is layed out, with time period for bottom panel appearing *above* the legend for the upper panels is very non-intuitive. The final panel (d) is very busy and takes a lot of time and effort on the part of a reader to comprehend. Why is it necessary/useful to show two temperature scales? Could the transition ranges and corresponding confidence levels not be rationalized and simplified? (e.g. by picking a single confidence level and adjusting the transition ranges accordingly). The figure/caption give no information as to how the risks are defined -- e.g. as some sort of globally-weighted value? as representative local/regional values? Surely the risks are not the same everywhere in the global ocean, but that is the inadvertent message conveyed by using global temperature as the vertical scale. [Government of Canada]
3514	SPM	18	1	18	1	It would seem unncessary to change the way that confidence levels for transition are displayed, compared to SR1.5. Please consider using the same graphics choices for this. [Government of Sweden]
4254	SPM	18	1	18	1	Consider adding a figure summing up (from section B) the avoided changes, impacts and risks under low emission vs high emission scenarios -- SPM 3 only shows parts of the findings. [Government of Norway]
5464	SPM	18	1	18	1	RCP2.6 exceeds 1.5°C and is classified as a 2°C scenario. The characterisation of RCP2.6 as a 'low emission scenario' is therefore highly questionable. In fact, this characterisation contains a value judgment statement and is not acceptable. Please also add a 1.5°C line to panel (d). [Government of Saint Kitts and Nevis]
5466	SPM	18	1	18	1	Global maps are informative, but more policy relevant information could and should be provided. Please consider adding inlays/bar-plots for panels a-c highlighting regional differences and temporal dynamics. For panel c, please provide specific information for the reduction in catch potential for SIDS as well as other regions. [Government of Saint Kitts and Nevis]
7488	SPM	18	1	18	1	For the figure SPM.3 d), it would be appreciated if you could specify criteria for “Very high”, “High”, “Moderate” of added impacts/risks. [Government of Japan]
7490	SPM	18	1	18	1	It is assumed that Figure SPM.3 d) is the integration of Figure 5.16 (Chapter 5, p. 70). We would suggest adding information on temperature by 2100 under RCP 2.6 and RCP 8.5 as in Figure 5.16 to call the reader's attention to emergency action. [Government of Japan]
7492	SPM	18	1	18	1	Since the range of uncertainty is different between Figure 5.18 on page 72 of Chapter 5 and Figure SPM.3 d, we would suggest revising to the correct value. [Government of Japan]
8418	SPM	18	1	18	1	Insert bar of figure 5.16A from SROCC Chapter 5 (page 70) referred to risk assessment for Eastern Boundary Upwelling Ecosystems, between the bars for 'Epipelagic' and 'Abbysal Plains' ecosystems. [Government of Peru]
2978	SPM	18	1	18	15	In figure SPM3d it is very confusing to include both global mean surface temperature, and global mean sea surface temperature. Is there a way of making this clearer? Perhaps put one of them on the right-hand axis instead? [Government of United Kingdom (of Great Britain and Northern Ireland)]

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868	SPM	18	1	19	4	Figure SPM.3 (p.18, l.1 to p.19, l.4) This figure is policy-relevant and has been significantly improved compared to the previous version. To improve it even further, please consider the following proposals. Subtitles a, b and c - For better readability, please add the temporal information from the caption in the subtitles a, b and c. We suggest : a) Changes in net primary production, 2081-2100 relative to 1986-2005 b) Changes in total animal biomass, 2081-2100 relative to 1986-2005 c) Changes in maximum fisheries catch potential, 2041-2060 relative to 1991-2010 Title Please consider changing the title as fisheries are not part of the ecosystem but rather human activity. We suggest "Projected changes and risks for ocean ecosystems and subsequent human fishing activities" Additional information Considering the importance of the impacts of SLR on coastal erosion, we suggest to insert a burning amber dedicated to this phenomenon, if possible. Caption lines 1-2« low confidence due to uncertainties associated with multiple interacting drivers and ecosystem responses in the Arctic and Antarctic regions that are »This statement is true for Arctic and Antarctic regions. However there is a high confidence in the decrease expected in tropical regions. Thus the whole paragraph is not balanced and details on tropical ecosystems should be added. [Government of France]
4034	SPM	18	1	19	4	SPM.3 conveys very important information and should be retained. Two suggestions for improvement: * In our opinion this figure could be understood to give the message that productivity, biomass and catch potential will be negatively impacted at low latitudes, but positively impacted in large parts of the Arctic. However, in the figure caption line 15 it says that "In the polar regions, projected change in b) total animal biomass and c) fisheries catch potential have low confidence...". This low confidence is not possible to understand only by looking at the figure. Please consider illustrating the confidence level better in the figure. In the figure, shaded areas seems to indicate regions with less confidence but only limited to where there are less agreement between the models. However, we feel that the situation for the polar areas is a bit different, since the reasons for low confidence here is that the models to less extent cover these areas and the ability per se of current models to resolve Arctic Ocean shelf sea processes and the biology. Therefore, the low confidence related to the polar regions should also be shaded in the figure. Also, the shading is hard to see at the higher end of the colour scheme used and the use of shading is not explained in the figure. Please consider making the shading visible throughout the colour scheme, and to explain the use of shading. * Please follow the example of this figure and use "warm water corals" and "cold water corals" consistently through out the SPM. [Government of Norway]
7098	SPM	18	1	19	4	In Figure SPM.3d, suggest replacing "epipelagic" with "upper 200m". Does "abyssal plain" signify the same system that "benthic floor" does elsewhere in the SPM? Harmonize terminology if necessary. The symbols for confidence levels in the transitions are very helpful. [Government of United States of America]
2972	SPM	18	2	18	15	Unsure if the average policy maker will understand the terms 'epipelagic' and 'abyssal plains' - the two right-most burning embers bars. Suggest these are defined in the figure caption. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3512	SPM	18	2	18	2	The inserts show the whole globe, not just "selected ocean regions". Please revise as appropriate. [Government of Sweden]
4392	SPM	18	2	18	3	No need to repeat the full phrase, if introduced earlier. Replace by "RCP". [Government of Monaco]
7100	SPM	18	2	19	4	It is not clear if ocean acidification impacts have been included here; such impacts will be largest at high latitudes due to the cold temperatures, and will not the increased acidification disrupt ocean ecosystems, or have a strong chance of doing so? [Government of United States of America]
1120	SPM	18	4	18	4	Suggest deleting the erroneous word: "from". [Government of Australia]
3668	SPM	18	4	18	4	Replace "based outputs from based on the" with "based on the outputs from the" [Government of Brazil]

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4394	SPM	18	4	18	4	"from based" Typographical error. Replace by "net primary production based on outputs from the Coupled Model..." [Government of Monaco]
4594	SPM	18	4	18	4	outputs from based on the..': either 'from' or 'based' needs to be deleted to understand the sentence? [Government of Belgium]
8332	SPM	18	4	18	4	The order in the sentence is a bit strange. Change the sentence to read "....integrated net primary production based outputs from based on outputs from the Coupled Model....." [Government of New Zealand]
8634	SPM	18	8	18	11	This sentence reads awkwardly for two reasons. First “a) and b)” can be misread as that text was omitted after a), and second the next sentence starts with “d)”, which can be misinterpreted as a continuation of the a), b), c) from the previous sentence, which it is not. While minor, the potential confusion is not welcome in a bit of text that may be hard to digest to the reader as it is. Suggestion: “Shaded areas in a) and b) indicate regions where models agree in the direction of change for at least three quarters of model projections, and in c) it indicates agreement for both models used. d) Risk assessment…” [Government of Netherlands]
7494	SPM	18	11	18	11	In Figure SPM.3, “Present day” refers to 2006 – 2015, while Figure 5.16 (Chapter 5, p. 70) mentions that “Present day” corresponds to the 2000s. We would suggest that the SPM use same expressions as those used in each Chapter. [Government of Japan]
818	SPM	18	49	19	2	The glacier lake outburst floods should be mentionned here (B7.) and in B7.1 [Government of France]
3516	SPM	19	1	19	1	Is this really a confidence level statement? If yes, what are the confidence levels for the other regions and parameters? [Government of Sweden]
3746	SPM	19	7	19	10	Can severe impacts be quantified? [Government of Ireland]
3518	SPM	19	7	19	14	Information would also be useful to provide from low emission scenarios, not just RCP8.5. [Government of Sweden]
3748	SPM	19	7	19	14	Can risks being high be defined or risks related to current levels, levels at 2C or higher global warming? [Government of Ireland]
5490	SPM	19	7	19	14	A separate paragraph should be added speaking to the information on saltwater intrusion and coastal erosion. In particular, the following high confidence statement from 4.3.3.4 should be added: "With rising sea levels, saline water intrusion into coastal aquifers and surface waters and soils is expected to be more frequent and enter farther landwards. Salinization of groundwater, surface water and soil resources also increases with land-based drought events, decreasing river discharges in combination with water extraction and sea level rise (high confidence)." [Government of Saint Kitts and Nevis]
7496	SPM	19	7	19	14	In this subsection of B6., 1.5°C and 2°C targets seem to appear fairly suddenly as standards for stringent mitigation, while RCP2.6 is used for the other subsections of Section B. It may be confusing to the reader, and thus, it would seem clearer if RCP2.6 were used for the entire subsection B6. In such a case that this proposal is deemed as inappropriate, it is requested that it could be clearly stated how much temperature rise relative to the preindustrial period would correspond to RCP2.6. [Government of Japan]
8582	SPM	19	7	19	14	This statement (B6) - a very important statement, even with 1.5 degrees is significant high risk [Government of Kiribati]
8592	SPM	19	7	19	14	This statement (B6) - a very important statement, even with 1.5 degrees is significant high risk. This has also shown that coral reefs will be virtually eliminated and so will be unable to provide coastal protection. Including coral reefs as a means for adaptation is thus unrealsitic and the risk should be higher under scenario B for atoll reef islands. [Government of Kiribati]
8688	SPM	19	7	19	14	Add first sentence B6.2 to B6. [Government of Netherlands]
8498	SPM	19	7	19	8	B6 headline. Again, use of 'by 2100' here implies that increasing risks of severe impacts on biodiversity, ecosystem function etc. are not projected until 2100. It is critical to better convey the timeline for increasing risks. [Government of Canada]
8026	SPM	19	9	19	12	The text addresses future risk without specifying the nature of the risk (risk of what?) or recognising the significant actual loss that has already taken place (that is, that the "risk" is about the future rate of already occurring losses). [European Union]
8334	SPM	19	9	19	9	Suggest "richness" be replaced with "diversity" [Government of New Zealand]
8686	SPM	19	10	19	10	add after high: "to very high" in line with B6.1, line 18 [Government of Netherlands]
8028	SPM	19	11	19	14	B6 & B6.4 The message on warm water corals is much less strong that the one under the 1.5 report. Efforts should be made to portray the dire situation of these ecosystems, which was much more forthcoming and precise under the 1.5 report, which said: “Coral reefs, for example, are projected to decline by a further 70–90% at 1.5°C (high confidence) with larger losses (>99%) at 2°C (very high confidence).” The language of “losses” has changed to “risks” language – losses are a factual statement, risks may never materialise. See also B6.4 - where the statement resembles the SR1.5 finding more closely. As per some of our comments, it would make more sense to place the coral statements together [European Union]
4396	SPM	19	12	19	12	"The capacity of ecosystems" Add "and organisms" [Government of Monaco]

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8030	SPM	19	12	19	13	The sentence as phrased seems oversimplified and can be misunderstood. The reduction of (non-climate) human disturbances would likely benefit the adaptive capacity of all ecosystems under any scenario (not just low-emission). The benefit of reduced disturbance would most likely be relevant already to present climate impacts, and certainly before differences in impacts across scenarios would emerge. Clearly, under low emission scenarios the adaptive capacity (increased by lower disturbance) could be expected to make adaptation more successful and/or to last longer, but it would seem incorrect to suggest that adaptive capacity could not be overwhelmed under low-emission scenarios, or that reducing disturbances could not make a significant difference under high-emission scenarios. Given that current emission trends are consistent with high-emission scenarios, the sentence can be read to suggest that reducing human disturbances in the present would not facilitate the capacity of ecosystems to adapt, which would be a questionable proposition. In addition, suggest referring only to adaptation, but not "response", as a response can be deleterious (like die-off). The focus should be on adaptive response only, Suggest rephrasing the sentence as follows: "The capacity of ecosystems to adapt is facilitated by the reduction of human disturbances under all scenarios, although the resulting adaptation benefits are less likely to be durable under high-emission scenarios". [European Union]
3750	SPM	19	12	19	14	Odd wording e.g. reduction of human disturbances [Government of Ireland]
8256	SPM	19	12	19	14	Useful sentence for policy makers - please retain in SPM [B6] [Government of New Zealand]
2980	SPM	19	13	19	13	can be facilitated by keeping temp rise below 1.5 degC (high confidence).' [Government of United Kingdom (of Great Britain and Northern Ireland)]
7102	SPM	19	13	19	13	"reduction of human disturbances" -- Such as? Some clarity is needed if this is referring to direct acitivites outside of indirect impacts of emissions, OA, etc. [Government of United States of America]
2992	SPM	19	13	19	14	By implication, these ecosystems will exceed their adaptive capacity under a high emissions scenarios - could you be explicit about this if possible? [Government of United Kingdom (of Great Britain and Northern Ireland)]
5240	SPM	19	13	19	14	The last sentence of B6 implies a very important signal for marine protection efforts. Unfortunately, Figure SPM.3 does not yet support this message very well. We hope authors will reconsider the chosen details of SPM.3 to bring the ecosystem change by habitat loss and community structure more into focus. That would help to advance the discussion of healthy oceans for a better climate resilience. [Government of Germany]
7104	SPM	19	16	19	23	If these statements concern projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
8500	SPM	19	16	19	23	please be consistent in presenting risk information in this paragraph. In the first sentences, risks are presented for different levels of global warming whereas in the latter part of the paragraph, they are presented for scenario RCP8.5 with no information provided about the corresponding level of global warming. Also, recommend conveying the levels of global warming when risks transition from one level to another consistent with the underlying assessment. [Government of Canada]
2984	SPM	19	16	19	24	B6.1 uses both temperatures and RCPs in the same paragraph which is confusing - suggest to use one or the other. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3520	SPM	19	16	19	24	More information would also be useful to provide from low emission scenarios, not just RCP8.5. Could also refer to SR1.5. [Government of Sweden]
5468	SPM	19	16	19	24	Warming of 1.5°C should not be characterised as 'moderate'. [Government of Saint Kitts and Nevis]
7106	SPM	19	16	19	24	On lines 16, 19 and 23, delete "under RCP8.5". It is not useful to imply that this outcome will not also be the case for all scenarios less than RCP8.5 just because no other scenario than RCP2.6 has been considered here. [Government of United States of America]
8032	SPM	19	16	19	24	B6.1 explains how these ecosystems are at high risk. High risk of what? Disappearing? [European Union]
8426	SPM	19	16	19	24	“All coastal ecosystems assessed will be at high to very high levels of risk under RCP8.5 by 2100, with risk levels for seagrass meadows (high confidence), kelp forests (high confidence), coastal upwelling systems (high confidence) and coral reefs (very high confidence) becoming high to very high already at moderate global warming of 1.5 °C above pre-industrial temperatures.” (RCP8.5, ver box 5.3 del capitulo 5] [Government of Peru]
8336	SPM	19	18	19	18	Slight re-ordering of the sentence: ".....reefs (very high confidence) already becoming high to very high already at moderate global warming...." [Government of New Zealand]
1450	SPM	19	19	19	19	Comparison between temperature rise and RCP requiers in depth understanding of RCPs [Government of Denmark]
2982	SPM	19	19	19	19	Suggested edit: 'at very high risk by 2100 under RCP8.5..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
7108	SPM	19	19	19	19	Insert "ecosystems" or "biological communities" after "intertidal rocky shore". [Government of United States of America]
8258	SPM	19	19	19	21	Not only “intertidal rocky shores will be at very high risk”....these pressure apply to all intertidal shores e.g. shellfish in estuarine intertidal areas are also impacted by warming, acidification and exposure to extreme heat. Intertidal habitats are also likely to be impacted by sea-level rise (see comment for B6.2). Please clarify scope of these impacts. [Government of New Zealand]

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7498	SPM	19	22	19	22	“Low latitude” is used in this sentence instead of “temperate regions” (Chapter 5, p. 68: Kelp ecosystems are expected to continue to decline in temperate regions). Since “low latitude” and “temperate regions” are not always identical, we would suggest using “temperate regions” in SPM. [Government of Japan]
5242	SPM	19	26	19	26	Range is very broad but confidence is high - also, a couple of lines later it is mentioned that wetlands can keep up with SLR. This statement is very unclear, please revise. [Government of Germany]
7110	SPM	19	26	19	26	In section A6.1 the text states that 50% of coastal wetlands have been lost since 1900. Here the authors need to clarify that they are talking about 20-90% of remaining or current wetlands. [Government of United States of America]
1122	SPM	19	26	19	27	Suggest clarification. Reading in conjunction with A6.1, lines 39-41, is the 20-90% based on current extent, if so this should be explained. If not, then how could the lower projection to 2100 be 20% when (reading A6.1) the loss in the 20th century was 50%? [Government of Australia]
2996	SPM	19	26	19	27	This section tells us how much coastal wetland is projected to be lost. Please clarify this refers to all emission scenarios if correct. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4170	SPM	19	26	19	27	The fact that 20-90% of coastal wetlands are projected to be lost under RCP8.5 is a strong statement that could be lifted into B6. Furthermore, please consider if the sentence could also include reference to the degree of global warming. [Government of Norway]
5472	SPM	19	26	19	27	Please be more specific on the scenario dependency of these reductions. [Government of Saint Kitts and Nevis]
1452	SPM	19	26	19	30	Change order wiht B6.1 and delete last 3 lines. [Government of Denmark]
3522	SPM	19	26	19	33	Which forcing scenarios do the 20-90% loss refer to? [Government of Sweden]
7112	SPM	19	26	19	33	It would help to clarify on lines 26-28 that the loss of existing coastal wetland areas will be very significant and, in suggesting that the percentage might be low, this is because of the potential for some of these wetlands to migrate inland, taking over new inland areas. On lines 30 and 31, "under RCP8.5" should be replaced by the phrase "under all emission scenarios that do not reach net zero toward the middle of the century". It is not just RCP8.5 that causes the problem. [Government of United States of America]
7114	SPM	19	26	19	33	The most important error in Section B6.2 is the statement that "mangrove forests, seagrass meadows, and saltmarshes can keep pace with sea level rise under low emissions scenarios for the whole 21st century". This is not true. Observed losses of marshes and mangroves during the 20th century have been attributed to sea level rise rates that were lower than the 0.4m "low emissions" scenario projected for the 21st century. Observed losses in Black Water National Wildlife Refuge and Everglades National Park are just a couple of examples. Each low-lying natural coastal system has a SLR threshold that is determined by local conditions and it is very misleading to state that these systems "can keep pace with sea level rise" at any rate that is being projected through the end of this century. [Government of United States of America]
2994	SPM	19	27	19	27	Does habitat degradation refer to human disturbances/anthropogenic processes beyond climate change? Could you clarify this language please? [Government of United Kingdom (of Great Britain and Northern Ireland)]
7116	SPM	19	28	19	28	This sentence needs to be corrected. If sediment supply is high, coastal ecosystems can accrete vertically or even seaward, in which cae they do not "migrate landwards". [Government of United States of America]
2988	SPM	19	29	19	29	It is unclear what is meant by mangrove forests, seagrass meadows and saltmarshes 'keeping pace' with sea level rise. Suggest this is clarified, i.e. range shifts able to keep pace with sea level rise. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7118	SPM	19	29	19	29	This statement is incorrect. Some wetlands cannot keep pace with sea level rise under low emission scenarios. See GEOPHYSICAL RESEARCH LETTERS, VOL. 37, L23401, doi:10.1029/2010GL045489, 2010, Limits on the adaptability of coastal marshes to rising sea level. Here is an excerpt: "These results suggest that expansive marshes in regions with low tidal ranges or sediment concentrations will likely submerge in the near future, even for conservative projections of SLR. For example, our models predict a threshold SLR rate of about 5 mm/yr for marshes in the Plum Island Estuary, the largest estuary in New England (Massachusetts, USA: SSC = 3 mg/L, TR = 3 m (C. Hopkinson, Dissolved nutrient and particulate concentrations of freshwater inputs to the Plum Island estuarine system, taken approximately monthly, Plum Island Ecosystem LTER Database, 2007), and for marshes in the Albemarle-Pamlico Sound, the second largest estuary in the United States (North Carolina, USA: SSC = 10 mg/L, TR = 0.5 m [Lunetta et al., 2009])." There are several other references with this same type of conclusion about low thresholds of submergence in some coastal systems. [Government of United States of America]
1124	SPM	19	29	19	30	Suggest including a qualifier: While this states that vegetation communities "can keep pace with sea-level rise under low emission 30 scenarios for the whole 21st century" the end of the para mentions landward constraints, which will limit this ability in many areas. [Government of Australia]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7500	SPM	19	29	19	30	The SPM says “Mangrove forests, seagrass meadows and saltmarshes can keep pace with sea-level rise under low emission scenarios for the whole 21st century, but only up to 2055 and 2070 under RCP8.5 (medium confidence)”. We would suggest SPM notes the maximum year for which each ecosystem can avoid their extinction one by one (for mangrove forests, 20XX, for seagrass meadows, 20YY, and for saltmarshes, 20ZZ). There are two reasons: 1) it is important to know which ecosystem cannot keep pace until 2070 under RCP 8.5 to take earlier action for their conservation; 2) Limitation for mangrove forests under RCP 8.5 is 2050 based on Chapter 5, p. 62 (for RCP 8.5 they are only resilient up to 2050 conditions), which seems to be in contradiction between current SPM and Chapter. [Government of Japan]
8260	SPM	19	31	19	33	Where landward migration of intertidal habitat is constrained there will also be loss of these habitats in addition to coastal wetlands. https://www.nature.com/articles/s41586-018-0805-8#ref-CR1 [Government of New Zealand]
8690	SPM	19	35	19	37	too many expert terms; unclear [Government of Netherlands]
2986	SPM	19	35	19	39	B6.3 uses many terms that non-experts will not be familiar with that should be defined, including hypoxia, benthic, pelagic, biota and eutrophic. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3352	SPM	19	35	19	39	B6.3: Not clear what is meant by "tidal changes". If there is one thing that doesn't change with AGW, it's the tides. Tidal amplitudes do have low-frequency variability (e.g., the 18.6 year cycle), but it's not clear what is meant here. [Government of Canada]
5474	SPM	19	35	19	39	Please be more specific on the scenario dependency of these impacts. [Government of Saint Kitts and Nevis]
7120	SPM	19	35	19	39	It needs to be made clear that these effects will extend well inland in many regions where tidal effects extend well up rivers, and that sea level rise will mean that these distances extend even further inland. Readers will tend to think of estuaries in terms of where they now are, but with sea level rise of a meter or so, large areas not now affected by tidal flows will be so effected. On line 38, change "under RCP8.5" to "if net fossil fuel emissions continue well beyond 2050" as this finding applies to many more scenarios than RCP8.5. And the word "more" should be dropped; under ongoing emissions scenarios, this will be the case in virtually all locations. [Government of United States of America]
3524	SPM	19	37	19	38	More pronounced than what? What is the comparison to? [Government of Sweden]
7122	SPM	19	37	19	39	This statement concerns projected impacts, so specify that they "are projected to be… (medium confidence)" or "have the potential to" rather than "will…". [Government of United States of America]
4398	SPM	19	41	19	41	B6.4 Chapter 5.3.4 mentions "Globally, coral reefs and their associated communities are projected to change their species composition and biodiversity as a result of future interactions of multiple climatic and non-climatic hazards" and in no way that the reef surface would decrease. This is a conclusion of SR1.5, recalled at the end of paragraph 5.3.4 (page 70). The present report mentions a decline only for an increase of +2°C relative to the preindustrial level. In any case, the report mentions that the decline will exist if global warming remains below +2°C. This sentence should therefore be amended. [Government of Monaco]
8034	SPM	19	41	19	41	The first sentence of B6.4 is not informative, as the majority of these reefs are already in decline, and there is no reason to assume that this would stop even under the most stringent scenarios. It should be made consistent with the reference to "remaining reef communities" in the second sentence, suggesting wide-spread loss. Suggest rephrasing the first sentence as: "Almost all warm-water coral reefs will suffer significant losses of area and extinctions even if global warming remains below 2°C (high confidence)". [European Union]
1004	SPM	19	41	19	42	Suggest making it simple for the policy/decision maker to take action on the 'big ticket' items that are almost irreversible changes. For example, there are some key results in this report that get lost in the text. Warm water corals declining dramatically, regardless of climate change futures, is a key result. [Government of Australia]
5470	SPM	19	41	19	42	A general statement on "below 2°C" is not sufficient. Please be specific on the risks at 1.5°C and 2°C. [Government of Saint Kitts and Nevis]
7502	SPM	19	41	19	42	The SPM explains the decline of warm-water coral reefs under 2°C of global warming. Also, Chapter 5, p. 64 mentions “warm-water corals at very high risk even if global warming can be limited to 1.5°C above pre-industrial level”. We suggest revising this sentence. [Government of Japan]
2990	SPM	19	41	19	45	Suggest B6.4 is elevated to B6 or the start up box as this highlights projections that show a total loss of a habitat with high confidence. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3354	SPM	19	41	19	45	This statement about projected declines in warm water coral reefs at GW below 2C seems much weaker than in the SR1.5. In the SR1.5, it was concluded that 70-90% of coral reefs will be lost at 1.5C, and that at 2C, these ecosystems will virtually disappear. (need to confirm exact language in the SR1.5). It is important to be clear if the two SRs are consistent in their conclusions or if newly published science had led to a change in conclusions. [Government of Canada]

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3526	SPM	19	41	19	45	This statement would seem to be much less "severe" than what was stated in SR15 (>99% loss of warm water corals for 2 degrees, and very high losses already at 1.5 degrees). Is this a new finding? [Government of Sweden]
4210	SPM	19	41	19	45	Projected impacts on warm-water coral reefs were quantified and related to different levels of global warming in the IPCC SR 1.5. Here, no numbers are given. Please consider giving some quantitative estimates related to various RCPs also here. [Government of Norway]
7124	SPM	19	41	19	45	Are the changes for coral reefs predicted with high confidence even if the global warming stays below 2°C, or are these predictions and confidences given assuming global warming exceeds that? [Government of United States of America]
7126	SPM	19	41	19	45	If these statements concern projected changes, specify that they "are projected to be… (confidence level)" or "have the potential to" rather than "will…". [Government of United States of America]
7504	SPM	19	42	19	43	We would suggest adding the information of how species compositions are changed to help reader's understanding. Chapter 5, p. 64 mentions “A phase shift is characterized by an abrupt decrease in coral abundance or cover, with concurrent increase in the dominance of non-reef-building organisms, such as algae and soft corals”. [Government of Japan]
7128	SPM	19	43	19	43	Replace "in" with "of". [Government of United States of America]
8036	SPM	19	43	19	43	Suggest replacing "The decline in coral reefs will greatly compromise" with "The loss of coral reefs will drastically reduce" [European Union]
8038	SPM	19	45	19	45	Why is the confidence lower for tourism than for the other services? The opposite would seem more reasonable, as tourism services are already compromised in many regions, whilst the decline in coastal protection will only become evident over a longer period (e.g., as reefs will fail to follow sea level rise). [European Union]
1368	SPM	19	47	21	10	The whole sections B.7 and B.8 are missing references to the scenarios used for this evaluation. [Government of Luxembourg]
7506	SPM	19	49	19	51	Considering the content, “and” in this sentence does not seem to be properly used, so this would be better corrected. For example. “Projected changes in the terrestrial cryosphere will affect water resources and their uses, such as hydropower, and irrigated agriculture, water quality in high mountain areas and downstream regions, and food security and livelihoods in the Arctic”. [Government of Japan]
3358	SPM	19	49	19	53	B7 section – Question of clarity: should terrestrial travel issues (e.g., permafrost degradation) be included in the listing of consequences to humans in line 53? Here and above implies overland travel by Indigenous peoples in the Arctic as opposed to effects on built infrastructure such as roads which are covered. [Government of Canada]
7130	SPM	19	49	19	53	If these statements concern projected changes, specify that they "are projected to be… (confidence level)" or "have the potential to" rather than "will…". [Government of United States of America]
8594	SPM	19	49	19	53	Negative impacts from natural hazards are well mentioned but would strongly suggests that a negative impact might have also affected natural resources or biodiversity (high confidence) in which SIDS like Kiribati depends on for cultural, recreational and tourism activities. [Government of Kiribati]
3356	SPM	19	49	20	2	The second sentence of summary box B7 is confusing. Recommended to rephrase: “will contribute to negatively impact” to “will have negative effects on” [Government of Canada]
3752	SPM	19	49	20	2	Can be clearer e.g. start with area being reffered to [Government of Ireland]
7132	SPM	19	49	20	2	In that the verb is only "will affect" (not even giving the sign), how can there be only "medium confidence" in the statements? There is no doubt that all of these changes will occur. The question is how significant the effects will be, and on such statements one might have only "medium confidence". So, as phrased here, these statements merit "high confidence" or "virtually certain". The statements here also lack an indication of how much more severe the conditions will be with ongoing emissions after 2050 as compared to getting to net zero before then. [Government of United States of America]
8262	SPM	19	51	20	2	Useful sentence for policy makers - please retain in SPM. [B7] [Government of New Zealand]
1126	SPM	19	52			Suggest deleting: "contribute to". [Government of Australia]
7508	SPM	19	52	19	52	We would suggest rephrasing the word “ground destabilization” to other words. Comparing with “floods, avalanches, and landslides”, ground destabilization is too general a concept and neither Glossary, Chapter 2 nor Chapter 3 provide an explanation of “ground destabilization.” [Government of Japan]
5244	SPM	19	52	19	53	The formulation "changes … will contribute to negatively impact …" sound convoluted, maybe as a consequence of the confusion about what constitutes a risk, a hazard or an impact. Please revise this sentence to make clear what is meant - is it that negative impacts are projected to occur, but only through parallel influences of various drivers? or should the sentence actually read "Changes…will increase risk to …"? Please clarify. [Government of Germany]
7134	SPM	19	53	19	53	"recreation" should be "recreational". [Government of United States of America]

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2998	SPM	20	1	20	1	independent of emissions pathway' - is this due to projected population change? Suggest a reason for this is provided for clarity. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3000	SPM	20	4	20	4	Natural hazards such as? floods, landslides and avalanches? Suggest these examples are spelled out. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8562	SPM	20	4	20	8	In paragraph B7.1, it is stated that "Current risk reduction and adaptation strategies are projected to become increasingly insufficient". We would however nuance this statement, by adding that in mountains, agriculture is often the backbone of the local economy, and therefore plays a critical role in ensuring that affected people maintain access to food and livelihoods during and after disasters, and in building resilience over time. [Government of Switzerland]
3002	SPM	20	5	20	6	Similar to above comment: what are the natural hazards in the Arctic? subsidence and soil movement? Suggest some key examples are included. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7136	SPM	20	7	20	8	Suggest a more targeted and productive statement pulled verbatim from the executive summary of Chapter 3 (bottom of page 3-6): "Responding to climate change in polar regions will be more effective if attention to reducing immediate risks (short-term adaptation) is concurrent with long-term planning that builds resilience to address expected and unexpected impacts (high confidence)." This statement applies to all regions, not just polar regions. [Government of United States of America]
8040	SPM	20	7	20	8	Suggest providing examples of current risk reduction and adaptation strategies that will become insuficient. Examples will illustrate to policy makers measure that will fall short. [European Union]
8042	SPM	20	7	20	8	Consider moving the sentence to section C, as it discusses response. [European Union]
8044	SPM	20	7	20	8	Suggest refrasing sentence"Current risk reduction and adaptation strategies are projected to become increasingly insufficient (medium confidence)" to “Enhanced risk reduction and adaptation strategies will become increasingly needed” [European Union]
3004	SPM	20	10	20	10	Permafrost thaw and melting of ground ice, causing land surface to subside and collapse, is presented as a future possibility, yet it has already been observed - "Chapter 3, 3.4.1.2.2 Ground ice Permafrost thaw and loss of ground ice causes the land surface to subside and collapse into the volume previously occupied by ice, resulting in disturbance to overlying ecosystems and human infrastructure (Kanevskiy et al., 2013; Raynolds et al., 2014)." Suggested the sentence is rephrased to clarify this. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7138	SPM	20	10	20	10	"may" is not a word in the IPCC lexicon as it can mean anything from 1% to 99%. This needs to say "very likely" or some similar choice in the IPCC lexicon. [Government of United States of America]
3360	SPM	20	10	20	16	The second sentence in subsection B7.2 says that the majority of Arctic infrastructure WILL BE located in regions where…” Should that should say “IS located.”? The first way means that people will build more in the path of harm in the future; the other means that the buildings are already in what will become the path of harm in the future. [Government of Canada]
4082	SPM	20	10	20	16	This point contains material that also fits within sections C1-C3 on Options and Enablers. Please consider moving. [Government of Norway]
3362	SPM	20	12	20	14	Suggested re-wording of first half of the sentence to emphasize that the risk is for existing Arctic infrastructure based on current projections of permafrost thaw -- "The majority of Arctic infrastructure is located in regions where permafrost thaw is projected to intensify by mid century;…" [Government of Canada]
748	SPM	20	13	20	13	We suggest adding some numbers here. For example, consider using Chap. 3 section 3.4.3.3.4 (ex : "A circumpolar study found that approximately 70% of infrastructure (residential, transportation and industrial facilities), including over 1200 settlements (~40 with population more than 5000) are located in areas where permafrost is projected to thaw by 2050 under RCP4.5 (Hjort et al., 2018)." [Government of France]
750	SPM	20	13	20	13	Please use "are" instead of "will" as they are currently located in regions where we project a permafrost thaw (it is not an estimation of future infrastructure installations). See chapter 3, p.3-76 : "A circumpolar study found that approximately 70% of infrastructure (residential, transportation and industrial facilities), including over 1200 settlements (~40 with population more than 5000) are located in areas where permafrost is projected to thaw by 2050 under RCP4.5 (Hjort et al., 2018)." [Government of France]
7140	SPM	20	13	20	13	Based upon the underlying chapter (3-76), this statement describes existing infrastructure that is located in areas of permafrost that are projected to thaw by 2050. Confirm that the statement is about 'existing' rather than 'projected' future infrastructure. If the former, suggest rephrasing to clarify: "The majority of EXISTING Arctic infrastructure IS located in regions where permafrost thaw is projected to intensify by mid century…" [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8338	SPM	20	13	20	13	Replace "will be" with "is" such that it reads: "The majority of Artic infrastructure will be is located in regions where..." [Government of New Zealand]
7142	SPM	20	14	20	15	Move "by half" after "reduce". [Government of United States of America]
8340	SPM	20	14	20	15	For meaning and readability change the ordering in the sentence to: "...adaptation measures taken in advance could reduce by half costs arising from thaw and other climate change-related impacts such as increased flooding, precipitation, and freeze-thaw events by half...." [Government of New Zealand]
3364	SPM	20	14	20	16	There is nothing in section 3.4.3 indicating that costs related to climate related impacts in the Arctic could be reduced by half if adaptation implemented in advance. In this section (3.4.3.3.4), only the difference in cost (24%) of damage between high and low emission scenarios is mentioned (results only from Alaska) not due to adaptation. I believe the section you should probably refer to is 3.5.2. Note there is no confidence associated with this statement in section 3.5.2. Given this is only based on Alaska, how applicable is it to the rest of the Arctic? - implying this is the case. [Government of Canada]
8046	SPM	20	14	20	16	The second part of the sentence, starting with "adaptation measures" seems to belong to Section C under the current structure. Consider moving it or restructuring the document in a way that discusses impacts and adaptation consistently together. [European Union]
1454	SPM	20	18	20	18	Irrigated agricultural activities in the Arctic?? Delete polar icon [Government of Denmark]
7144	SPM	20	18	20	19	Where does "some regions" refer to? Are declines in agricultural productivity applicable to Arctic communites generally, or are specific regions or communities of people particularly vulnerable to this impact? [Government of United States of America]
7146	SPM	20	18	20	19	"some regions" is too vague to be useful. Is this referring to some regions in the Arctic or all around the world? And how do reductions in runoff affect agriculture? Are there regions in the Arctic where runoff is stored and then used for irrigation, or is this referring to river flows pulled off for irrigation. [Government of United States of America]
7510	SPM	20	18	20	19	We consider the information on the conditions for the referred phenomenon to occur to be important, because climate change itself is expected to have both positive and negative impacts on food availability. We would suggest changing the text for example: For 1st sentence, “Declining runoff is expected to occur in some regions and cause to reduce the productivity of irrigated agriculture in those regions;” and for 2nd sentence, “Reduced access to, and food availability within, the current condition of herding, hunting...” [Government of Japan]
7540	SPM	20	18	20	19	Could you be more specific? Where productivity of irrigated agriculture is expected to be reduced? [Government of Finland]
5246	SPM	20	18	20	21	Listing infrastructure in this sentence "reduced access to, and food availability within, ... Infrastructure,... does not make sense. Could be amended by moving infrastructure as a separate point to the end of the sentence "...diseases, and degrading or inaccessible infrastructure, will diminish food and water security..." [Government of Germany]
8564	SPM	20	18	20	33	The summary sheds light, separately, on the reduction of productivity of irrigated agriculture in some regions and on the negative impact on high mountain cultural assets and tourism and recreation activities induced by climate change. The summary could further explore the possible relation(s) / linkage(s) between these two phenomena and explain how they influence each other. [Government of Switzerland]
8048	SPM	20	19	20	19	insert "freshwater aquaculture" after "fishing" to read: "fishing, freshwater aquaculture, forage" [European Union]
7148	SPM	20	19	20	21	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
7150	SPM	20	19	20	21	This sentence needs clarification. It also needs to include mention that reductions in sea ice are going to make sustainable/traditional harvesting much more difficult as sea ice has traditionally served as a platform for Indigenous harvesting and hunting. Basically, some clarification is needed and an indication why irrigated agriculture is mentioned in preference to Indigenous and traditional harvesting and gathering. [Government of United States of America]
1456	SPM	20	23	20	23	Add polar icon [Government of Denmark]
8342	SPM	20	23	20	23	"amount" should be plural: amounts [Government of New Zealand]
7152	SPM	20	23	20	24	If this statement concerns projected changes, specify that they "are projected to be... (likelihood/confidence)" or "have the potential to..." rather than "will...". [Government of United States of America]
7154	SPM	20	23	20	24	The sentence needs to give some indication of the regions where this point is applicable. Does this mean in the Arctic and/or elsewhere, such as regions dependent on glacial runoff like the rivers starting up in the Himalayas, etc. [Government of United States of America]
4640	SPM	20	23	20	26	The conclusion of reduced water quality due to pollutants stored in glaciers IN GENERAL is not supported by the text in Ch.2 p.30, where regional, limited and highly uncertain impacts are described. [Government of Russian Federation]

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8450	SPM	20	23	20	26	We salute the mention of the release contaminants, particularly heavy metals, by glacier melt as it is potentially very important for Peru. [Government of Peru]
8502	SPM	20	24	20	26	No timeline is given for this statement about projected declines in water quality from release of heavy metals and other contaminants currently stored in glaciers and permafrost, nor any sense of the whether or not this poses a risk to human health even though the use of this water for household use is mentioned. There is no similar statement about future changes in water quality from release of contaminants in the ExSUmm to Ch. 2. The statement in the main chapter states that changes in water quality from release of contaminants from mountain cryosphere will influence downstream water quality with no mention of how this may impact downstream water users. and no confidence statement is associated with this statement in the main chapter. [Government of Canada]
7156	SPM	20	28	20	28	"recreation" should be "recreational". [Government of United States of America]
4178	SPM	20	28	20	33	This point contains material that also fits within sections C1-C3 on Options and Enablers. Please consider moving. [Government of Norway]
7158	SPM	20	28	20	33	Why is this point not indicating how significant the loss of winter snow will be in 2100 under the high emission scenario? It will essentially be gone (or greatly shortened) if global warming reaches a few °C, and mid-summer warming and loss of runoff (so stream-related activities) seems likely to pose a major limit for promoting summer activities, etc.? [Government of United States of America]
8050	SPM	20	28	20	33	This comment is valid for B7.5 as well as for A7.5: Articificial snowmaking is a 'maladaptation'. It has serious impacts on the water cycle and on the vegetation layer. It is a very short-sighted measure. Suggestion to delete this sentence or add a qualifyer that makes it clear that artificial snowmaking is not a viable solution. [European Union]
5248	SPM	20	29	20	32	Please consider to remove the reference to artificial snow-making. Rationale: Artificial snowmaking is an adaptation measure which is not sustainable and should therefore not portrayed as an appropriate measure. The following sentence (L32-33) is important for development under climate change conditions. See also our comment to P-11 L43-44: [Government of Germany]
7160	SPM	20	29	20	32	The use of the word "already" is confusing. Are temperatures in Europe, North America, and Japan already above 1.5°C? Since the statement about effectiveness of adaptive measures at 2°C is a projection, it could be rephrased as "...and are projected to further decrease effectiveness at 2°C of global warming and higher levels (high confidence)." [Government of United States of America]
7162	SPM	20	29	20	32	This statement compares the effectiveness of current adaptation strategies under a 1.5°C temperature increase and a 2°C temperature increase. However this is not how it is presented in the underlying chapter. The authors have extrapolated a bit too far in this instance by making an arbitrary comparison between conditions at 1.5 and 2°C. The more accurate point to make is that certain atmospheric conditions, namely low air temperature, are needed to sustainably make artificial snow and, as air temperatures rise, this becomes more difficult and less efficient. Comparing conditions at 1.5 and 2°C scenarios is useless for this specific impact. Underlying Chapter 2 (pages 50-52) specifically states this: "The effectiveness of snow management methods as adaptation to long-term climate change depends on sufficiently low air temperature conditions needed for snowmaking, water and energy availability, compliance with environmental regulations (de Jong, 2015), and ability to pay for investment and operating costs. When these requirements are met, evidence over the past decades shows that snow management methods have generally proven efficient in reducing the impact of reduced natural snow cover duration for many resorts (Dawson and Scott, 2013; Hopkins and Maclean, 2014; Steiger et al., 2017; Spandre et al., 2019a)." [Government of United States of America]
8052	SPM	20	29	20	32	As in A7.5, reference to artificial snow as an "adaptation strategy" should be deleted. In the current structure, adaptation should be discussed in Section C (or the structure should be reordered around topics, so that adaptation issues are not separated from observed and projected changes, see our general comments). Wherever artificial snow is discussed, it should be recognised as a possible case of maladaptation, as it is targeted to extend a rather high-impact, non-essential activity at a significant environmental cost, potentially making the future situation (ability to adjust to a new reality if snowmaking loses effectiveness) worse. [European Union]
7164	SPM	20	30	20	31	Strike "global". This sentence appears to discuss regional rather than global warming. [Government of United States of America]
7166	SPM	20	31	20	31	Remove "already". [Government of United States of America]
3006	SPM	20	32	20	32	Suggested edit: 'Diversification, through businesses moving into activites not dependent upon snow abundance, supports adaptation..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
1578	SPM	20	32	20	33	Diversification through active tourism products is an important adaptation option for ski destinations, so mentioning this aspect here is really important and approved. [Government of Hungary]
7554	SPM	20	35			The first sentence on line 35 is difficult to understand. It would help to add a word before "potential fish catches", e.g. "decreases in fish catches". [Government of Finland]

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8344	SPM	20	35	20	35	Replace "potential fish catches" with "fisheries catch potential" [Government of New Zealand]
1128	SPM	20	35	20	36	Suggest correcting grammar for the first two lines of B8. [Government of Australia]
3754	SPM	20	35	20	36	Can resource dependent communities be defined in this context? [Government of Ireland]
4196	SPM	20	35	20	36	"..due to climate change will affect..." -- consider adding ".. climate and ocean acidification.." [Government of Norway]
7168	SPM	20	35	20	36	If this statement concerns projected changes, specify that "Projected decreases ...are expected to...." rather than "will...". [Government of United States of America]
3014	SPM	20	35	20	40	Mariculture is recognised in the report (ref Chapter 5, pg 75) as an important marine ecosystem provisioning service, but no information on the projected impacts are included in the SPM. Suggest that a summary of projections, e.g. "overall decline in mariculture potential by 2100 under RCP 8.5. with large regional variations" should be included. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5250	SPM	20	35	20	40	B8 does not provide a full summary of the subsections B8.1-83, ignoring the important issues of health, harmful algae booms, or vulnerable coastal infrastructure. Please revise. [Government of Germany]
5478	SPM	20	35	20	40	This section should include a separate paragraph B8.4 on the economic relevance of the sector. Chapter 5 includes this information: "For example, when the elasticity of seafood price in relation to their supply was modelled explicitly, fisheries maximum revenue potential under a 1.5°C atmospheric warming scenario was projected to be higher than for 3.5°C warming by 7.4% ($13.1 billion USD) ± 2.3%, across projections from three CMIP5 models (Sumaila et al., 2019). Accounting for the subsequent impacts on the dependent communities and relative to the 1.5°C warming scenario, that study also projected a decrease in seafood workers' incomes of 7.8% (US $3.7 billion) ± 2.3% and an increase in households' seafood expenditure by the global population of 3.2% (US $6.3 billion) ± 3.9% annually under a 3.5°C warming scenario (Sumaila et al., 2019)." [Government of Saint Kitts and Nevis]
5494	SPM	20	35	20	40	Please include a separate paragraph on the risks from harmful algal blooms. From Chapter 5: "Overall, the occurrence of HABs, their toxicity and risk on natural and human systems are projected to continue to increase with warming and rising CO2 in the 21st century (high confidence). The increasing likelihood of occurrences of HABs under climate change also elevates their risks on ecosystem services such as fisheries, aquaculture and tourism as well as public health (high confidence)." [Government of Saint Kitts and Nevis]
7170	SPM	20	35	20	40	B8 summary has a reference to 6.4, yet it is not present in subsections B8.x. [Government of United States of America]
7172	SPM	20	35	20	40	Any statements regarding projected fisheries catch should be 'low confidence'. [Government of United States of America]
7174	SPM	20	35	20	40	Is this comment for the global community or mainly for those in the Arctic? Nothing is said about the political discussions going on regarding fishing in the Arctic Ocean, not knowing of stocks and their ability to sustain large-scale harvesting, EEZs, etc. This all seems quite general, not making clear that some communities may well be devastated by the shifts, and others might benefit. [Government of United States of America]
8264	SPM	20	35	20	40	Useful paragraph for policy makers - please retain in SPM. [B8] [Government of New Zealand]
8530	SPM	20	35	20	40	B8: This is already happening and well known for many countries, so can this be classified as "medium confidence". Lack of data/research? [Government of Kiribati]
4596	SPM	20	35	20	45	Some need for consistency: all the verbs either in future or in present tenses: 'will ' or 'are' (e.g. line 36 'will affect' versus line 45 'are widespread' [Government of Belgium]
752	SPM	20	36	20	36	Please check if "marine resource-dependent communities" would not be more accurate [Government of France]
3756	SPM	20	37	20	40	"Alter" could be quantified or defined [Government of Ireland]
7176	SPM	20	39	20	39	"culture"should be "cultural"; "recreation" should be "recreational". [Government of United States of America]
3008	SPM	20	42	20	43	decreases of global marine animal biomass and fish catch potential' - Does this apply under all scenarios? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8054	SPM	20	42	20	43	Insert "aquaculture feed" after biomass to read: "and fish biomass, aquaculture feed and fish" [European Union]
3528	SPM	20	42	20	47	Information would also be useful to provide from low emission scenarios, not just RCP8.5. [Government of Sweden]
4214	SPM	20	42	20	47	Quantitative estimates of changes in catch potential for RCP2.6 and RCP8.5 at high and low latitides could be described here. Some noteable examples of regional hotspots could also be useful. Please consider including this. Part of this text is also dealing with issues that could fit within section C1. [Government of Norway]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5252	SPM	20	42	20	47	B8.1: We suggest to add a sentence on relationship between the issue of revenue and vulnerable communities, which is discussed in detail in the full report (p.5-87/p.5-88), e.g. something along the lines of "Regions where the maximum potential revenue is projected to decrease coincide with areas where indicators such as human development index suggest high economic vulnerability to climate change." or "Climate change impacts are expected to reduce harvests from small-scale coastal fisheries by up to 20% by 2050, and by up to 50% by 2100, under RCP8.5." [Government of Germany]
7178	SPM	20	42	20	47	Bracketed references should include 6.4.2.1. [Government of United States of America]
7180	SPM	20	42	20	47	Include some statistics on fraction of nations/people that are very dependent on protein from the ocean, then an indication that demand is going up although overall fish stocks have gone down -- and climate change is causing shifts to different locations and into EEZs contolled by other nations, etc. So while there are overall shifts and changes, some are very important to some nations, and some of these specific problem locations need to be mentioned. [Government of United States of America]
7578	SPM	20	44	20	44	“Fishery area user” sounds a strange expression. Couldn’t you just say “fishermen”? [Government of Finland]
4400	SPM	20	44	20	45	The possibility of conflicts over resource use should be highlighted further. In particular, there is increased evidence of conflicts arising over fishing rights. [Government of Monaco]
3010	SPM	20	45	20	45	or between communities' - for example, where territorial rights are exerted over fixed, demarcated fishing areas? It would be useful to unpack this. [Government of United Kingdom (of Great Britain and Northern Ireland)]
5476	SPM	20	45	20	47	Please be specific on what regions are "regional hot-spots". Looking at SPM3, these hot spots will include SIDS. [Government of Saint Kitts and Nevis]
4238	SPM	20	49	20	49	"climate change hazards and ocean acifidication.." [Government of Norway]
7182	SPM	20	49	20	49	Why is the word "hazards" here? Is it not just general climate change that is causing the problems? [Government of United States of America]
7722	SPM	20	49	20	53	This paragraph should be merged with B8.1 since they deal basically with the same subject. [Government of Spain]
3366	SPM	20	49	21	5	Loss of seafood availability is a particularly large concern for communities that have limited alternative sources of essential nutrients that are currently obtained from seafood (Chapter 5; 5.4.2.1.3.) and for communities that do not have culturally acceptable alternatives for certain seafood. The challenge of limited alternative food sources should be clearly stated in the last sentence of B8.2 [Government of Canada]
7184	SPM	20	49	21	5	B8.2 should have reference to 6.4.2.3. [Government of United States of America]
7186	SPM	20	49	21	5	It is not clear if this statement applies to communities in the Arctic, or around the world. Indicate what communities are likely to be affected. Also, there is no mention of impacts of this type due to ocean acidification, and sea level rise, which will affect the breeding areas of a number of fish species. [Government of United States of America]
8056	SPM	20	49	21	5	B8.2 clarify how the different concepts in this statement correspond to the "security" and "safety" labels of the first sentence. i.e. the former refers to nutrition and the latter to presence of pollutants and contaminants? [European Union]
8058	SPM	20	49	21	5	Chapter 5.4.2 also indicates the potential for microplastics to bio-accumulate due to their very high persistence and potential to get into the food-webs. It might the worthy mention them in this point B8.2 [European Union]
5254	SPM	20	50	20	52	B8.2: In comparison to the full report (p.5-83/p.5-84), the part on food security in the summary is not very reader-friendly. We would like to emphasize the importance of translating and explaining given information into a reader-friendly (non-scientific) language, as it strongly supports the rationale of the SPM. [Government of Germany]
7188	SPM	20	50	20	52	Chapter 5 (pages 5-83 to 5-84) describes dietary shifts from "traditional nutritious wild caught seafood-based diets … towards increased consumption of processed energy-dense foods high in fat, refined sugar, and sodium, due to social and economic changes." Suggest that the corresponding sentence in the SPM be revised to clarify that the other shifts are not related to climate change: "…adding to existing risks from shifts in diets and food system due to social and economic changes (medium confidence)." [Government of United States of America]
8062	SPM	20	51			Insert "and aquaculture production" after "catch" to read: "…catch and aquaculture production potential" [European Union]
7190	SPM	20	51	20	51	"some coastal communities" is far too vague. Provide examples. [Government of United States of America]
8060	SPM	20	51	20	51	Delete "on some coastal communities". Seafood is consumed much more widely than in just "coastal communities". [European Union]
1130	SPM	20	52	20	52	Suggest inserting: "the" before "food system". [Government of Australia]
754	SPM	20	53	20	53	Please reword "can increase" with "should continue to increase, at least in some regions" [Government of France]
3012	SPM	20	53	20	53	Suggested edit: 'bioaccumulation of contaminants in seafood, such as persistent..' [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	Chapter	From page	From line	To page	To line	Comment
8504	SPM	20	53	21	1	Sentence is not correct as written. Climate change can increase the exposure TO contaminants that have bioaccumulated. End sentence here. There are too many results packed into one sentence here. [Government of Canada]
5256	SPM	20	53	21	3	The potential role of bio-availability of contaminants and increasing effects of similar hazards in a changing climate is very important in the context of future efforts of marine protection. We recommend to include in B8 a short statement summarizing B8.2. [Government of Germany]
958	SPM	21	1	21	5	Small Island developing States should be mentioned here because they are very dependednt on fisheries for diet and livelihoods. [Government of Jamaica]
3372	SPM	21	1	21	5	There is also (and should be mentioned) an issue of food security particularly for Indigenous Peoples in the North in regards to terrestrial organisms. It is understood that this report is focused on the cryosphere and oceans, however, the permafrost degradation effects on land travel will affect access to terrestrial renewable resources (e.g., everything from berries to mammals). That consequence should be noted somewhere and somehow as a logical outcome of permafrost loss, land-form changes, and hydrological effects on terrestrial areas. There is also a 'downstream' consequence of this which includes higher sediment loading to estuarine and coastal areas; while likely localized this will ultimately affect coastal biodiversity and productivity. Some of this information may not be in the basic report from which this summary is derived. However, some appropriate strategy for addressing this and including these likelihoods is required (to ensure that people do not default to the 'this is the only change to happen'). If topics and analyses are missing in the report but logical outcomes should be raised, perhaps an additional 'Other Consequences and Linkages" section outlining these should be added to the Summary. [Government of Canada]
7192	SPM	21	4	21	5	"These risks are particularly large for human communities that have high consumption of seafood, including coastal Indigenous communities (medium confidence) {3.2.5, 5.4.2; Box 5.3}" It would make sense to reference both local and indigenous knowledge. [Government of United States of America]
3016	SPM	21	5	21	5	Does this statement refer only to Arctic communities? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7512	SPM	21	5	21	5	The reference might not be correct, as chapter 3.2.5 does not exist. It seems to be chapter 3.4.3. [Government of Japan]
8064	SPM	21	5	21	5	There is a reference here to chapter 3.2.5 which does not exists [European Union]
8066	SPM	21	5	21	5	Do not capitalise "indigenous". [European Union]
3368	SPM	21	7	21	10	It is important to note in this section the rapidity of erosion of Indigenous culture due to climate change as well as the irreversability of cultural loss (5.4.2.) [Government of Canada]
7194	SPM	21	7	21	10	Impacts on cultural dimensions has been assessed with medium confidence, instead of high confidence. Is this due to a paucity of research and published findings on these issues? [Government of United States of America]
7196	SPM	21	7	21	10	While Indigeneous communities are mentioned, does this statement just apply to them, just to people in high latitudes, or people around the world? This needs to be clarified. [Government of United States of America]
3370	SPM	21	8	21	10	Local' and 'Indigenous' again should not be lumped together here. Suggest removing 'local' or moving the local references to a separate sentence. This is based in fact that Indigenous Peoples have distinct rights and these are often made to be weakened or softened, intentionally or not, through language that does not recognize Indigenous Peoples (and their culture, knowledge, etc.) as distinct. [Government of Canada]
7198	SPM	21	8	21	10	It is not clear how "climate change impacts on marine ecosystems" impact indigenous cultures, knowledge, or spiritual appreciation. Suggest clarifying or deleting. [Government of United States of America]
7200	SPM	21	8	21	10	Fix sentence; "erosion of" applies to several but not all words/phrases following. [Government of United States of America]
3018	SPM	21	9	21	10	opportunites for aesthetic and spiritual appreciation' - what is spiritual appreciation? Suggests this is defined if including the term in the SPM. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8068	SPM	21	9	21	9	Do not capitalise "indigenous". [European Union]
3758	SPM	21	12	21	14	Use projected rather than will [Government of Ireland]
960	SPM	21	12	21	20	The broad brush approach used here for responses places SIDS at a disadgantage because "Retreat" is not an option for SIDS. [Government of Jamaica]
4088	SPM	21	12	21	20	Please also consider quantifying the risk, e.g. from the findings in B9.2. [Government of Norway]
5480	SPM	21	12	21	20	This top level statement includes important information on the limits to adaptation that should be maintained. [Government of Saint Kitts and Nevis]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7202	SPM	21	12	21	20	KEY ISSUE [STRUCTURE]: Why is this very important comment only noted as B9 instead of appearing in a summary on page 1 and being more prominent in the chapter, and at least in the section on the effects on people. SPMs (so information being provided to decisionmakers) need to be written with the most important results up front, not at the back as is perhaps traditional with scientific papers. The SPM needs to catch the attention of policymakers on page 1 with the key conclusions then offer the supporting information for the points, not the other way round as this SPM is organized. Basically, the approach used should be like what politicians use: tell them what you will tell them, tell it to them, and then tell them what you told them. Right now, the organization requires tremendous time and concentration to get to where the most important findings are conveyed. [Government of United States of America]
8266	SPM	21	12	21	20	Useful paragraph for policy makers - please retain in SPM. [B9] [Government of New Zealand]
5258	SPM	21	12	21	41	We suggest to add a short para on the role of non-climatic drivers to the SPM under "Projected risk for people" (B9), based on the following lines from Ch4-ES: "Non-climatic anthropogenic drivers, including recent and historical demographic and settlement trends and anthropogenic subsidence, have played an important role in increasing low-lying coastal communities' exposure and vulnerability to sea level rise and extreme sea level events (very high confidence). In coastal deltas, for example, these drivers have altered freshwater and sediment availability (high confidence). In low-lying coastal areas more broadly, human-induced changes can be rapid and modify coastlines over short periods of time, outpacing the effects of SLR (high confidence). Adaptation can be undertaken in the short- to medium-term by targeting local drivers of exposure and vulnerability, notwithstanding uncertainty about local SLR impacts in coming decades and beyond (high confidence; 4.2.2.4, 4.3.1, 4.3.2.2, 4.3.2.2., 4.3.2.3). [Government of Germany]
7204	SPM	21	12	21	41	There is no mention of the relationship and role of other drivers of exposure and vulnerability in this section. The authors should draw upon information in the underlying report to describe how other non-climate factors affect the risks associated with sea level rise. [Government of United States of America]
8070	SPM	21	12	21	42	B9 - the headline statement should contain at least one of the powerful, quantified findings from within the section. E.g.: "Some island nations might become inhabitable due to climate-related ocean and cryosphere change (medium confidence)" [European Union]
3020	SPM	21	13	21	13	Suggested edit: '...exacerbate risks to communities in low-lying coastal cities, small islands..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
756	SPM	21	15	21	15	Please consider specifying "all actions in response to". Otherwise, there may be a confusion with the physical responses [Government of France]
1458	SPM	21	15	21	15	Many -if not most- low lying Arctic communities are prone to experience sea level fall due to glacial isostatic forces and rebound. The text seem to be based on figure 4.3 og the technical report. [Government of Denmark]
5488	SPM	21	15	21	16	This statement is policy prescriptive: "All types of responses to sea-level rise, including protection, accommodation, ecosystem-based adaptation, advance and retreat, have a role to play in an integrated and sequenced response to sea-level rise." Also, responses are being analysed in section C. Should be deleted. [Government of Saint Kitts and Nevis]
7206	SPM	21	15	21	17	This statement is potentially policy-prescriptive. Consider revising. [Government of United States of America]
8072	SPM	21	15	21	17	Under the current structure of the SPM, the sentence beginning in "All types of responses" seems to belong to Section C. Consider moving it or restructuring the document in a way that discusses impacts and adaptation consistently together. [European Union]
758	SPM	21	16	21	16	Accomodation should be defined in the glossary [Government of France]
8074	SPM	21	16	21	16	It is questionable whether "advance" can be considered an adaptation measure. It is typically not done in response to sea-level-rise, but for other reasons, and it does not make adjustment to higher sea levels easier, but more difficult. [European Union]
4402	SPM	21	17	21	19	This sentence is identic to the nearest two words to a sentence in paragraph C1.3: "Vulnerable human communities, especially those in coral reef environments, high mountains, and along Arctic coasts, may face adaptation limits well before the end of this century, even under low emission scenarios" [Government of Monaco]
5260	SPM	21	17	21	19	We recommend to use the concept "limits to adaptation" in a way that is more coherent with the definition provided in the glossary, including in the identified place in the SPM and underlying chapters (SPM, p. 23, l. 28-34; SPM, p. 28, l. 17-19; Ch1, p.24, l.24-26; CCB7, p.10, l.5 and CCB7, p.10, l.30). Qualifiers or further explanations are required for the usage of the concept of "limits of adaptation." The instances should much better reflect that potential limits of local adaptation measures strongly depend on the Representative Concentration Pathways (RCP) and the context-specific risk tolerance. This comment also applies for the above mentioned findings in the underlying chapters. Also, the sentence in Ch.1, p.24, l.1-3 lacks clarity. By splitting the sentence, the rationale for linking adaptation to mitigation could become easier to grasp. We also suggest to add an example for adaptation measures that may increase GHG emissions. [Government of Germany]

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Comment id	Chapter	From page	From line	To page	To line	Comment
1370	SPM	21	17	21	20	The concept of "adaption limits" needs to be put into context. It should reflect that potential limits of local adaptation measures strongly depend on the scenario considered and the context-specific risk tolerance. [Government of Luxembourg]
1492	SPM	21	18	21	19	The concept of "limits to adaptation" should be used in a more coherent way with the underyling chapters and glossary definition. We suggest providing more context and clarity, also in relation to the RCP and the local adaptation measures considered. [Government of Italy]
3768	SPM	21	18	21	19	Avoid term such as "even under" provide quantification and refer to warming levels and reference how these link to temerature goals in Paris Agreement [Government of Ireland]
7208	SPM	21	18	21	19	KEY ISSUE [JARGON]: The term "adaptation limits" is not used anywhere in the underlying chapter. Helpfully, Chapter 4 is much more specific about the various types of responses, their distinct limits, and the unique reasons for their limits. Section 4.4 outlines the different limits for responses to sea level risk, including protection, accommodation, and ecosystem-based adaptation, among others. The term "adaptation limits" is not a useful short-hand term to represent the diversity and range of limits associated with the various responses. Suggest that the authors find another way to describe these limits in the SPM. [Government of United States of America]
8076	SPM	21	18	21	19	There is a need to be more precise in the use of “limits to adaptation”, which is a concept not introduced in the text. It is important to recall that: the concept of adaptation options that are (technically and politically) feasible is dynamic, as new solutions emerge and preferences change, and vary very much depending on local circumstances and context-specific risk thresholds. Suggest that the sentence should be changed to: Some vulnerable communities, especially those in low-lying coastal areas, small islands, and polar regions, could face limits to adaptation well before the end of this century with current risk reduction and adaptation options and preferences, even under a low greenhouse gas emission pathway. [European Union]
7210	SPM	21	18	21	20	Suggest rewording this sentence to better emphasize the urgency of the situation. The summary sentence of some communities facing "adaptation limits" before the end of the century feels less urgent than the way this topic is dicussed in subsection B9.2. [Government of United States of America]
1494	SPM	21	20	21	20	There is no Chapter 6.3.4 [Government of Italy]
7212	SPM	21	20	21	20	B9 summary includes a reference to a non-existent section 6.3.4. [Government of United States of America]
7214	SPM	21	20	21	20	B9 needs references to 6.4, 6.8, and 6.9.2 since they are mentioned in B9.1 and B9.3. However, there is no obvious link to 6.4. [Government of United States of America]
1132	SPM	21	22			Suggest clarification: why is the text "major adaptation efforts" in bold font? Should this also be done for other phrases? [Government of Australia]
7216	SPM	21	22	21	23	The executive summary of Chapter 4 clearly states that non-climatic drivers have played a dominant role in increasing coastal community exposure and vulnerability. This should be noted alongside "without adaptation efforts" in the SPM text to emphasize that this scenario goes beyond a lack of adaptation efforts, but it assumes that coastal communities will continue to have exposure and vulnerability due to non-climatic drivers. The text should be edited to say: "B9.1 In the absence of major adaptation efforts and a continuation of non-climate drivers that have played a dominant role in increasing the exposure and vulnerability of coastal communities, risks are …" [Government of United States of America]
7218	SPM	21	22	21	26	Presenting findings from the impossibly unlikely scenario of "no adaptation efforts" is not useful to policymakers. There is no future in which there will be no adaptation efforts to respond to sea level rise. The SPM should cover the deep and robust discussion in the underlying report on the opportunities for adaptation and the related challenges. Also, the use of qualitative terms such as "major" is subjective. There is no agreement on what is a "major" adaptation effort. [Government of United States of America]
8532	SPM	21	22	21	26	B9.1: What is is explained on this section, it is already happening in many places, so there is need to talk more of what it is now happening than what will happen. [Government of Kiribati]
5484	SPM	21	24	21	24	The assessment of increasing damages is very important. Please provide absolute estimates instead of only relative increases. Please also consider providing regional detail e.g. on the relative damages for small islands. [Government of Saint Kitts and Nevis]
140	SPM	21	24	21	25	The following wording is suggested in order to enhance clarity: For example, under the above assumption annual flood damages are expected to increase by …. [Government of Austria]
7220	SPM	21	24	21	25	There is not enough information presented here to justify the inclusion of this estimate in the SPM. If the increase of damage by 2100 is under a scenario of no adaptation -- namely hard measures to protect coastal cities -- then this is not a realistic scenario and should not be provided as an example with high confidence in the SPM. Delete this sentence. [Government of United States of America]
7222	SPM	21	24	21	25	Does the projected increase in damages apply to a specific RCP or to multiple RCPs? Clarify. [Government of United States of America]
760	SPM	21	24	21	26	Please add "Because of a stronger vulnerability (urbanization mostly)." [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4154	SPM	21	24	21	26	How does the increase in annual flood damages of 2-3 orders of magnitude relate to RCPs? Please consider elaborating on this. The text in B9.1. could also be considered for inclusion in C1 instead. [Government of Norway]
3374	SPM	21	25			Changes in flood damages due to SLR is of key interest to policymakers and readers. But the projected range is vague (2-3 orders of magnitude). Recommend replacing with assessed 'likely' range. [Government of Canada]
762	SPM	21	25	21	25	"damages": Please add "amounts". It's quite clear in the report, but in this sentence it could be equivocal. [Government of France]
3022	SPM	21	25	21	25	increase by 2-3 orders of magnitude by 2100' - does this also reflect all scenarios as per the previous sentence? Please clarify. [Government of United Kingdom (of Great Britain and Northern Ireland)]
8078	SPM	21	25	21	25	Replace "annual flood" with "annual coastal flood" if the numbers represent that. If all climate change driven floods are included in the figures, then it should be clearly noted, as the context suggests otherwise. [European Union]
5262	SPM	21	26	21	26	For the reader, it would be preferable to have the text from the paragraph in Chapter 4 ExSum P-5 "Due to projected global mean sea level rise, extreme sea level events (ESLs) that are historically rare (for example, today´s hundred-year event) will become common by 2100 under all RCPs (high confidence). (…) In the absence of adaptation, more intense and frequent extreme sea level events, together with trends in coastal development will increase expected annual flood damages by 2-3 orders of magnitude by 2100 (high confidence)." in the same place instead of spread across B3 and B9. If that is structurally not possible, we would recommend to extend the sentence in lines 25-26 as follows: "For example, due to frequent extreme sea levels and trends in coastal development, annual flood damages are expected to increase by 2-3 orders of magnitude by 2100 (high confidence)" [Government of Germany]
1134	SPM	21	28	21	28	Suggest defining "urban atoll"? [Government of Australia]
7224	SPM	21	28	21	28	Presumably this should say "Urbanized atoll islands". [Government of United States of America]
142	SPM	21	28	21	29	The following wording is suggested in order to enhance clarity: .. will experience high to very high risks even under a low emissions scenario (RCP2.6) [Government of Austria]
7226	SPM	21	28	21	29	If this statement concerns projected risks, specify that they "are projected to be… (likelihood/confidence)" or "have the potential to…" rather than "will…". [Government of United States of America]
7228	SPM	21	28	21	29	Are the "high" and "very high" risk here part of the IPCC calibrated language? [Government of United States of America]
4180	SPM	21	28	21	33	Is it possible to give an estimate also of the number of people that could have their homeland submerged by 2100 under other scenarios, such as 1,5C warming and RCP8.5? A map showing the geographical distrubution of coastal areas at particular risk from flooding could also be useful for illustrative purposes, ideally also illustrating the difference between high and low emission pathways. [Government of Norway]
7230	SPM	21	28	21	33	It would seem appropriate to mention that the worsening situation will continue as it will take several centuries for sea level to stop rising. And, it might be noted that for higher emissions scenarios the situation will become rapidly worse due to the increased risk of major collapse of particular ice streams from the Greenalnd and Antarctic ice sheets. [Government of United States of America]
8506	SPM	21	28	21	33	Strongly recommend being consistent in how risks are presented in this paragraph. Ideally relative to different amounts of global warming, vs mixing RCP scenarios and levels of global warming. [Government of Canada]
8534	SPM	21	28	21	33	B9.2: Any option to give a projection not that far (2100), and work on a projection that people alive now a days could see such as 2050? 2100 falls far for the actual generation, and it is well known that impacts can be seen already quite clear. [Government of Kiribati]
8618	SPM	21	28	21	33	Add to B9.2 information about what urban atoll islands, delta regions and some Arctic communies will experience at RCP8.5 [Government of Netherlands]
8692	SPM	21	28	21	33	Then also indicate the level of people at risk under a RCP8.5 scenario. [Government of Netherlands]
8742	SPM	21	28	21	34	Why does IPCC limits itself to 2100?..It is with high confidence that the risk or impacts emerged from the ocean and cryosphere will be unfold way beyond 2100 where it can also inform SIDS for effective adaptation measures with costings. A suggestion if greater timeframe beyond 2100 and its impacts could also be provided. [Government of Kiribati]
764	SPM	21	29	21	31	This sentence appears quite clear, but the confidence level is low. Please insert a statement with a higher confidence or delete [Government of France]
1136	SPM	21	29	21	31	Suggest that if 'low confidence' statements are including in the SPM, they should be less specific than this figure, of 280 million by 2100. Suggest clarifying how this number was arrived at (particularly as in the start-up box it is stated that 1 billion people will live in coastal areas by 2050) – it could be more general with a resulting higher confidence level. [Government of Australia]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5264	SPM	21	29	21	31	The number of people that may lose their "homeland" under a 2°C-scenario without adaptation given here is based on one single study and should therefore not be included in the SPM. While we support the inclusion of uncertain estimates with low confidence in general, the evidence base for this statement seems too weak to support it being highlighted in the SPM. Also, the assumption of "no adaptation" may not be very useful given that many coasts will take (and are already taking) protective measures, and is not in line with the evidence cited in the underlying text (CCB9-8; l: 12-14). To reflect increasing risk of involuntary displacement in the context of rising sea levels, we suggest to replace that statement by the following lines from CCB9, p 8 l55: “Human migration and relocation are expected to be a growing challenge for low-lying islands and coasts (medium evidence, high agreement)” [Government of Germany]
5486	SPM	21	29	21	31	Please add information on 1.5°C [Government of Saint Kitts and Nevis]
7232	SPM	21	29	21	31	The finding that SLR will submerge the "homeland" of 280 million people is not found in the underlying chapter. Again, presenting only the no-adaptation scenario with low confidence does not warrant inclusion in the SPM. The SPM should be consistent with statement 9 of the Chapter 4 executive summary which clearly states the difficulty of attributing impact to climate-related SLR and the benefits of short- to medium-term adaptation efforts. [Government of United States of America]
3626	SPM	21	29	21	32	These are key statements of the SPM and should be supported by further (regional) literature to strengthen the level of confidence. Also, this assessment further amplifies the statement in line 37 to 38 ("Even with major adaptation efforts, loss and damage will occur due to residual risks (medium confidence), but limits to adaptation and residual risk remain diffult to assess"). Given the severe implications of this, we ask to provide more information on loss and damage for SIDS in particular. [Government of Nauru]
7234	SPM	21	30	21	30	Define "submerge"? Below MLLW datum? MHHW datum? Big difference. [Government of United States of America]
8080	SPM	21	30	21	30	Clarify what the 280 million figure represents. Does it mean the area that is currently inhabited by 280 million people, or it takes into account projected population increases? [European Union]
8346	SPM	21	30	21	30	"homeland" should be plural: homelands [Government of New Zealand]
3530	SPM	21	30	21	31	What is the underlying population scenario? Also, it would be useful with some detail on why the confidence level is low. Is it due to emission uncertainties? SLR projections? Population scenarios? Etc. [Government of Sweden]
7236	SPM	21	30	21	31	"may" is not in the IPCC lexicon; change to "very likely". "could" also is not in the IPCC lexicon; change to "are likely". In that this is a statement with "low confidence", this change would not seem to be problematic. [Government of United States of America]
8082	SPM	21	32			changes (plural) [European Union]
5266	SPM	21	35	21	35	B9.3 "The benefits of adaptation are expected to vary between regions." - it is unclear what benefits are being referred to, statement is too generic. Please specify. [Government of Germany]
5482	SPM	21	35	21	38	This statement includes important information on the limits to adaptation and loss and damage that should be maintained. [Government of Saint Kitts and Nevis]
962	SPM	21	35	21	41	Very good bullet. Should be kept in its entirety and with the same wording.Very good message being given here. [Government of Jamaica]
4194	SPM	21	35	21	41	This text is also related to adaptation efforts and could therefore be considered to move it to part C in the SPM. [Government of Norway]
5268	SPM	21	35	21	41	The issue of residual risks, due to the time lag in ocean impacts should be explained further. [Government of Germany]
7238	SPM	21	35	21	41	Text would be stronger if some of the adaptations presented in 6.4 were mentioned -- for example, in 6.4.3 (page 6-34): "SST forecasts ranging from seasonal to decadal (5-10 years) have also been used or are planned to be used as early warning systems for multiple other ecosystems and fisheries in addition to coral reefs, including aquaculture, lobster, sardine, and tuna fisheries." [Government of United States of America]
1402	SPM	21	37	21	37	Please rephrase "loss and damage will occur due to residual risks" to " "residual risks and associated losses will occur". [Government of Denmark]
1496	SPM	21	37	21	37	The sentence should refer to "losses and damages" as per the glossary definition. [Government of Italy]
5270	SPM	21	37	21	37	In all instances where "loss and damage" (lower case letters) is used, it should refer to either losses or damages or both. In some instances, the wording "residual risks and associated losses" might be a good alternative to avoid the politically sensitive and ill-defined terminology "Loss and Damage" - in line with the framing of the cross-chapter box 1 and with the wording in the outline of AR6. We strongly encourage the authors to revise the text here, and also rephrase the relevant sentences in the underlying report, e.g. Ch1, p.20, 21; Ch1, p25; CCB, p.5, l. 30; CCB, p. 10, l. 8; Technical Summary p.36. [Government of Germany]

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8084	SPM	21	37	21	37	In line with glossary of AR6, the expression "loss and damage" (singular) should not be used, as this may be confused with a reference to the political debate under the UNFCCC following the establishment of the Warsaw International Mechanism for loss and damage. In the context of the report, the expression rather refers to harm from impacts and (projected) risks. In order to be consistent (also with the terminology used in the rest of the SPM), the sentence should be rephrased to read: "Even with major adaptation efforts, residual risks and associated losses may remain" [European Union]
8348	SPM	21	37	21	37	consider inserting "unavoidable" after "efforts" and make "loss and damage" plural thus: "Even with major adaptation efforts, unavoidable losses and damages will occur due to residual risks…." [Government of New Zealand]
820	SPM	21	37	21	38	Please rephrase as "Even with major adaptation efforts, residual risks exist and associated losses will occur. Limits to adaptation and residual risks remain difficult to assess." [Government of France]
1372	SPM	21	37	21	38	The wording "loss and damage" could imply that these findings related to a specific political context. In order to avoid any confusion please rather use the wording "losses and damages", in line with the framing of the cross-chapter box 1 [Government of Luxembourg]
7240	SPM	21	37	21	38	KEY ISSUE [JARGON]: The term "adaptation limits" is not used anywhere in the underlying chapter. Helpfully, Chapter 4 is much more specific about the various types of responses, their distinct limits, and the unique reasons for their limits. Section 4.4 outlines the different limits for responses to sea level rise, including protection, accommodation, and ecosystem-based adaptation, among others. The term "adaptation limits" is not a useful short-hand term to represent the diversity and range of limits associated with the various responses. Suggest that the authors find another way to describe these limits in the SPM. [Government of United States of America]
7242	SPM	21	37	21	38	KEY ISSUE [JARGON]: The term "loss and damage" is not used in the underlying chapters to describe losses associated with the impacts of climate change, including sea level rise. Provide the underlying chapter reference associated with this statement. Following an in-depth review of Chapter 4, a notable omission is that this section of the SPM fails to mention one of the most critical adaptation efforts in the short-term: targeting the local drivers of exposure and vulnerability. The Chapter 4 executive summary (page 4-3) includes a useful paragraph on the issue of reducing exposure as a strategy for managing the risks associated with sea level rise. [Government of United States of America]
7244	SPM	21	37	21	38	KEY ISSUE [JARGON]: The use of the political term "loss and damage" for which there is no agreed upon definition within the policy community is unnecessary. Revise the sentence to read as follows: "Even with major adaptation efforts, residual risk of impacts from climate change will likely remain (medium confidence), though their extent is difficult to assess." [Government of United States of America]
5272	SPM	21	37	21	40	The SPM refers to the "Integrative Cross-Chapter Box: Low Lying Islands and Coasts" with view to occurring damage. The Cross-Chapter Box includes numbers on damage from a government report neither assessing how valid the information is nor contextualizing to what extent the damages were attributable to climate change or were exacerbated by underlying exposure and/or vulnerability. The authors are strongly encouraged to revert to peer-reviewed publications or contextualizing the numbers provided (Integrative Cross-Chapter Box 9, p.5, l.39). Also, the Cross-Chapter Box does no longer cover the Warsaw International Mechanism, so the cross-reference of Chapter 6 (p. 58) to the box should be removed. In the same location, Ch6 (p.58) contains a wrong information on the work of the WIM as it is beyond the mandate of the WIM to address limits to adaptation at the global scale. Please revise to make sure that the information contained in the chapter correctly reflects the work of the WIM. [Government of Germany]
4404	SPM	21	38	21	38	In line with C1.3, the text should be clearer in emphasizing that there are adaptation limits. It is just the timing and the scope of those limits that remain difficult to assess. [Government of Monaco]
5274	SPM	21	38	21	39	Assumingly, in "There is however high confidence that ambitious adaptation will help to buy time in many locations and therefore facilitate adaptation beyond 2100", the first mentioning of adaptation should read mitigation? Please revise or clarify. [Government of Germany]
5276	SPM	21	38	21	39	"Buying time", wording rather ill chosen. Suggest rewording: There is however high confidence that ambitious adaptation will reduce risks in many locations and therefore facilitate adaptation beyond 2100. [Government of Germany]
3024	SPM	21	39	21	39	Suggested edit: 'facilitate the necessary further adaptation…' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4406	SPM	21	39	21	39	What does "ambitious" means? [Government of Monaco]
3376	SPM	22	0			The white dots on the maps and the associated white legend for figure SPM.4 are somewhat mis-leading. That is, the implication is that a white dot symbolizes an extreme event beyond 2100. It is unclear to me, how that can be projected when there are so few past data upon which to base such a projection for extreme northern areas where the majority of the white dots occur. Should there be a third panel to the figure that summarizes the observed past frequency of extreme events? [Government of Canada]

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Comment id	Chapter	From page	From line	To page	To line	Comment
144	SPM	22	0			Figure SPM.4, figure caption: The following wording is suggested to enhance clarity: Due to projected global mean sea level rise, extreme water level events that have been historically rare (e.g., those that, in the past, were induced once in a century by intense surges) will become common (once per decade or once per year). [Government of Austria]
1158	SPM	22	0			Suggest clarifying what is meant by "extreme events", for the panel C caption. Is this just for sea level? And what is a sea level event? (Panel A title). [Government of Australia]
1374	SPM	22	0			Figure SPM.4: Panel a): We do not understand the purpose of the lower black curve with gray shading (going down and the up). If it has no meaning please remove. Also this panel seems to indicate that sea level is stabilizing in the future, which is not the case. This should be reflected. [Government of Luxembourg]
1376	SPM	22	0			Figure SPM.4: Panel c): This panel seems to indicate, that some regions do not experience extreme events (no dots) or that the number of region where extreme events become more often is not different between RCP8.5 and RCP2.6. Both is not correct and should be reflected. [Government of Luxembourg]
4600	SPM	22	0			The message from the figure (RCP2.6 mainly delaying impacts compared RCP8.5) does contradict somehow what is written in the report and the SPM at other places, i.e., that strong mitigation leads to further reduction of changes (e.g., page 13 line 2-3) [Government of Belgium]
7556	SPM	22	0			Smooth reading would be facilitated by having a larger space between words "b) Average occurrence of extreme sea level events" and "1/month" below that text. Reader now easily makes a connection between those parts of the text. [Government of Finland]
4408	SPM	22	0	22		a)Very approximate The difference between curves should increase with time. It is to simplistic. Ordinate axis is missing a unity which can be: "number of extrem events". c) Map under RCP2.6 should be the first, and map under RCP8.5 beneath. Maps do not allow an easy comparation. [Government of Monaco]
4602	SPM	22	0	22		SPM 4: added value of panel C for policymakers? Panel C as it is could be misleading at least for the Regions were the risks are high for RCPC 2.6. The difference with RCP 8,5 is not visible. We suggest to revise the figure. For the SPM it would be sufficient to limit to 2 projections and to revise the lay out of fig. 4.12 in the underlying report. Also in the underlying report , the figure should be revised: colour scale, …. etc. [Government of Belgium]
8090	SPM	22	0	22		Figure SPM.4 * the definition of an extreme sea level event (a once per century event occurring more frequently) should be more prominent e.g. as a subtitle. This definition it essential to understanding the diagram. It is more important than the existing sub-title, which would be better placed as a paragraph within the SPM text itself since it is not directly related to the figure. * the "unit" of an event occurring per decade or century is confusing in this diagram. Sometimes this is a constant: for example the text defines an extreme sea level event as exceeding levels that occurred on average once per century during the recent past. Other times, it is a variable unit, as in panel a) which re-defines 'once per century' by showing that this threshold will refer to a higher sea level in the future than it did in the past. Recommendation: remove panel a) since it contradicts the rest of the diagram. The notion that a true 'once per century' event will occur at even higher sea levels in the future can be explained quickly in text. [European Union]
1404	SPM	22	1	22	1	Panel c is difficult to discern. It is not possible to read the information of the coloured dots, where they are very dense and overlapping, e.g in Japan, Europe and west coast of the Americas. The white dots are hard to see, too low colour contrast to the colour of the continents [Government of Denmark]
3378	SPM	22	1	22	1	Sea-level projections generally show an ongoing rise, not stabilization as sketched in panel (a) of this figure. This will be a source of misunderstanding if not corrected. [Government of Canada]
3532	SPM	22	1	22	1	The figure is very complicated, especially panel (b). Please consider whether all the content is really needed for the communication of the key findings. [Government of Sweden]

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870	SPM	22	1	22	13	Figure SPM.4 (p.22, l.1 to p.22, l.13) This figure is relevant but quite difficult to read. Please consider the main messages which should come out from this figure in order to make it more readable. Currently, the difference between RCP8.5 and 2.6 does not show up at first glance on the maps. Some regions where sea level rise and extreme events will matter are underrepresented here. If the main point is to introduce the projected occurence of some extreme events, and that some areas are not enough prepared, please consider the following proposals: instead of the current maps with discrete points representing years when historical extrem events become commun, we suggest to represent the local sea level rise for different scenarios, which would make it possible to draw a more complete map (i.e. West African coast is not informed in the current figure). More specifically, for panel (a), we suggest keeping 1/century, etc. on the right and 1/century, etc. on the left as it is now, but please do not connect them, since it gives the impression that the sea-level rise will stabilize at the end of the Century. Caption line 6-8 (b) may be something should be added to make sure the reader understands that it is not a direct output of CMIP5 projections, but estimations of glacier melting + downscaling. Text under the title Please consider adding « even under non extreme (or normal) wind conditions » after « common ». It would reinforce the message. [Government of France]
1138	SPM	22	1	22	13	Suggest adjusting this figure to improve its usefulness visually. First the colour coding in the maps in c) makes it difficult to see the difference between RCP 2.6 and RCP 8.5. Both maps are difficult to understand without the context of how many places experience "extreme" sea level events now. Because the baseline period is 1986-2005, the implication is that some areas may already be experiencing the once per year events (?) If so this should be stated. The graph b) similarly shows so much overlap between RCPs 2.6 and 8.5 that some readers might conclude there's no detectable significant difference between the two scenarios, and thus there's no point in trying to make the effort to achieve the RCP 2.6 trajectory. [Government of Australia]
1460	SPM	22	1	22	13	It is not clear if the calculation behind the figure are based on evenly distibuted MGSLR or takes into the reginal distibution fo SLR into account. [Government of Denmark]
3028	SPM	22	1	22	13	SPM4a is a helpful and intuitive figure that easily shows how extreme SLR events have increased/are projected to increase. however SPM4b is much less intuitive and does not give much more information. Suggest that it may be useful to delete SPM4b, and instead extend SPM4a so that instead of just showing 'recent past' and 'future', it shows 'recent past', 'low emissions future' and 'high emissions future' [Government of United Kingdom (of Great Britain and Northern Ireland)]
3030	SPM	22	1	22	13	SPM4c is problematic, as without looking very very closely, it is difficult to tell the difference between the RCP2.6 and RCP8.5 scenarios. Also, it is not clear from the figure alone that this is not an exhaustive list of locations where extreme events occur, or are likely to occur, it just looks at the change in frequency between at a set of specific pre-determined locations. Therefore, it gives the impressions that under RCP8.5, there are no new dots, therefore no new locations are impacted by extreme events, which is a clearly innaccurate message to portray. It may be better to pick a small number of specific examples and construct a figure to show how extreme events in those locations are likely to evolve, in a more obvious way, without suggesting they are exhaustive. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7246	SPM	22	1	22	13	Add "not to scale" to the Panel (a) subtitle. [Government of United States of America]
7248	SPM	22	1	22	13	KEY ISSUE [EXTREMES]: The main issue with a probabilistic threshold (e.g., 100-year event) as a rare extreme is that the viewer is not shown the height of such event. Some areas it will be very high (e.g., U.S. Gulf Coast) and catastrophic and, in others, flooding won't be even noticeable (e.g., Hawaii). Either provide heights of the 100-year event or use a major flood threshold [e.g., per recent NOAA reports (1.2-1.35 m above MHHW)]. Then an apple-to-apple comparison can be made. Another issue is that record length varies in the tide gauges shown, which introduces statistical bias. Also need to clarify if relative/local sea level rise projections are being used. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7250	SPM	22	1	22	13	Given the size of uncertainty in (a) and the fact that the differences between RCP2.6 and 8.5 are not obvious in (c), perhaps this figure could be pared down significantly. (1) Refer to "extreme sea level" throughout because, in this context, "extreme events" alone could describe storms as well. (2) When statements concern projected changes, specify that they "are projected to be…(confidence level)" or "have the potential to" rather than "will…". (3) Does the map in (c) represent the year when extreme water level events that occurred once a century in 1986-2005 are projected to occur once a year? If so, the label for the plot should be "Year when extreme water level events that occured once per century in 1986-2005 occur once per year". [Government of United States of America]
1490	SPM	22	1	22	2	It is unclear what the significance and the level of confidence in plot c are. Without a level of confidence, such level of detail doesn't seem appropriate for the SPM. [Government of Italy]
4036	SPM	22	1	22	2	This is a very important figure, please keep it. However, we have a few suggestions that could make it easier to read: Part a) *Please consider to include a label for the y-axis. Part c) * We find that the cirlces cover the land and overlap with each other in a way that makes it difficult to obtain correct information. Furthermore it is somewhat difficult to compare the two scenarios. It could perhaps be easier to get relevant information if part c was split up into regions instead of the whole world map. We would suggest especially highlighting regions at high risk. *The white circles are somewhat difficult to see. Could these be made more visible? * Please consider connecting legend for c) better together with the graphic, as it now looks like it belongs to the b) graphic. [Government of Norway]
5278	SPM	22	1	22	2	Figure SPM.4 (b) delete the text boxes; all information is already given in the caption [Government of Germany]
5280	SPM	22	1	22	2	Figure SPM.4 (c) shows points overlying each other (e.g. Europe). Clarity will be gained be showing less points, as e.g. in Figure 4.11., or by showing only points where tide gauge data is available for a long period, or by using averages of a region. [Government of Germany]
5286	SPM	22	1	22	2	Figure SPM.4: A visual display of the risk of extreme sea level rise is a very valuable addition to the SPM which we support in general. We have a few suggestions for improvement and simplification: 1) we would very much appreciate an extension of the assessment shown beyond 2100, e.g. panel b could quite easily have an additional slice for the post 2100 period, with graphic elements highlighting the different level of confidence/uncertainty; 2) we see several issues with panel c and would strongly suggest to revert to an (improved) version of SOD Figure SPM.6 (for regional averages), or design a version based on Figure 4.11, displaying a similar message with globally balanced coverage based on selected stations with long tide-gauge records; for brevity and simplicity, please also consider to delete panel c, as the regional differentiation can also be addressed in the text. Problems with current panel c include: a) colour scale is counterintuitive, and it seems as if white overwrites other colours, making it difficult to actually identify the individual spots; > 400 individual dots are a level of detail that can not be clearly perceived by the eye; the difference between RCP8.5 and RCP2.6 is not very evident on first (and second) glance, even though it is clearly very large in the underlying data; the relative lack of dots on the African continent is a concern with regard to regional balance; and finally, it is not really clear what the basis of this graph is - in Chapter 4, the origin of Figure 4.12 is not as well referenced and described as that of Figure 4.11. As said in our comment on whole SPM/section B3, we'd also encourage the authors to extract the key messages from this graph in an even more concise manner in a separate section. [Government of Germany]
5288	SPM	22	1	22	2	Panel a needs to be better explained or revised, it is currently not clear what the lines refer to, and that the "basin" depicts coasts of the past and future. [Government of Germany]
7514	SPM	22	1	22	2	It is stated that “Under all RCPs, low-lying islands will experience such events annually by 2050…”. However, in Figure SPM. 4 c) RCP2.6, some islands seems to be shown in yellow (i.e., by around 2080). It may be better to modify “low-lying islands” to “most low-lying islands”. [Government of Japan]
7516	SPM	22	1	22	2	It is not clear what the curved line, consisting of down-slope, flat bottom and up-slope between the present and the future, means in Figure SPM4 a). It is desirable either to add some explanation about this line or to modify the figure to avoid confusion. [Government of Japan]

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8086	SPM	22	1	22	2	SPM.4 Panel c) should be reconsidered. It is not very informative compared to its rather large size, and closer inspection reveals inconsistencies. If retained, the following should be considered: - In the horizontal colour scheme (bottom left), the first two boxes (2000-2020) refer essentially to the past. Scenarios can differ in this period only if they begin to diverge before 2010, meaning that some data pertaining to the past are not represented on the basis of observations, but predictions. This should be stated or (if possible), that period be dropped. - Based on the large overlap of the two scenarios in panel b) up to around 2030, one would expect minimal or no differences between scenarios in the maps (panel c) for these years. However, some dots suggest noticeable differences involving periods before 2030 (e.g., the dot corresponding to the Solomon Islands or on the coast of the Arabian Peninsula). - Some points (e.g, on the western coast of South America) suggest an earlier onset of annual extreme events for RCP2.6 than for RCP8.5. This seems counterintuitive. [European Union]
8636	SPM	22	1	22	2	The authors may want to consider using 1) a larger plot, 2) smaller dots and 3) splitting the figure up between regions (or a combination) in order to improve the interpretation. In many areas it is impossible to discern individual data points. [Government of Netherlands]
5282	SPM	22	1	22	8	Figure SPM.4 Caption: delete "Representative Concentration Pathway" [Government of Germany]
5284	SPM	22	1	22	8	Figure SPM.4 Caption: do not use "17-83 percentiles" but write "likely range" instead [Government of Germany]
3026	SPM	22	3	22	13	SPM4: Opening paragraph: 'are historically rare' - please define the baseline frequency, it is unclear what 'in the past' refers to. Also, map c): the coloured dots are a little bit crowded together - could these be made slightly smaller so it's easier to distinguish them? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4598	SPM	22	3	22	3	"in the past' : those words appears superfluous [Government of Belgium]
3670	SPM	22	8	22	8	Replace "Representative Concentration Pathway RCP8.5" with "RCP8.5" [Government of Brazil]
7252	SPM	22	8	22	8	Why is Representative Concentration Pathway written out here? [Government of United States of America]
8244	SPM	22	8	22	8	full name not necessary here [Government of Austria]
7558	SPM	22	9	22	10	It appears that no horizontal line to denote "once per decade" is included in the graph. Either the line should be added or "once per decade and" deleted. [Government of Finland]
3380	SPM	22	12		13	Does the figure show relative sea level changes? (i.e. change relative to local land elevation). Please clarify in the caption. [Government of Canada]
4410	SPM	22	16	22	16	Capital letters [Government of Monaco]
8088	SPM	22	16	28	32	The presentation appears to be biased towards hard adaptation measures. While the report clearly highlights how nature based solutions/ecosystem services can contribute to mitigate the expected effects of climate change, in particular sea level rise, this is not fully reflected in the SMP. [European Union]
3796	SPM	22	22	1	13	Put in temperature ranges rather than RCPs [Government of Ireland]
8092	SPM	23	1	26	21	There is no discussion here of some issues raised in 5.5 such as renewable energy and open ocean mitigation,(fertilization etc.). Some text should be included [European Union]
7712	SPM	23	1	26	22	the part on "Challenges" is uncomplete, only talks about governance challenge, while there are others such as conflicts with other disciplines (biodiversity,...), financial constrains, ecological limitations, etc. [Government of Spain]
5362	SPM	23	1	28	31	Reducing risk from extreme events and compound risks can be facilitated by better integration of adaptation planning with disaster risk management, including prevention and early warning systems. While this notion was part of the last SPM draft (e.g. C3 "Integrating climate change adaptation and (disaster) risk management implies intensifying coordination among different government agencies from a local to global scale.....", C3.6) and is still part of the underlying report (e.g. Section 1.7, CCB4, Section 2.3.2, most notably 2.3.2.3, 2.4, Tables 5.8 and 5.9, 6.8, 6.9 and across the adaptation discussion in Chapter 4), this draft SPM is largely silent on disaster risk management and its interlinkages with risk reduction and adaptation. We'd welcome a carefully drafted statement on the synergies of disaster risk reduction and adaptation efforts, a reference to the work of the UNISDR Sendai framework, and the contribution of risk insurance to increase resilience (cf. 6.9). Unfortunately, the central statement from Chapter 6 ES (p6-6) seems to have lost its actual meaning during editing: "Limiting the risk from the impact of extreme events and abrupt changes leads to successful adaptation to climate change with the presence of well-coordinated climate-affected sectors and disaster management relevant agencies (high confidence)." is, in our view, a non-sequitur and should please be revised. [Government of Germany]
5428	SPM	23	1	28	31	Overall, section C could emphasise more the issue of long-term (beyond 2100) commitment to sea level rise, e.g. in a dedicated key message. [Government of Germany]

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7714	SPM	23	1	28	31	The structure of part C makes sense, but the allocation of text doesn't. there are challenges under options, there are options under enablers, etc. text should fit the structure or structure should be changed, but as it is now is very confusing. [Government of Spain]
8094	SPM	23	1	28	31	The whole Section C is too vague and generic. As it is, it will be difficult for policy makes to use this report to develop actionable stategies to mitigate and adapt to the impacts of cliamte-induced changes in the ocean and cryosphere. [European Union]
3382	SPM	23	3	23	5	This is another example of applying a confidence qualifier to a factual statement -- the qualifier should be removed [Government of Canada]
976	SPM	23	3	23	6	Header should include limits to adaptation to tie in better with underlysing bullets. [Government of Jamaica]
1512	SPM	23	3	23	6	In an effort of being consistent, it would useful to include limits to adaptation to tie in better with underlysing bullets. [Government of Saint Kitts and Nevis]
3760	SPM	23	3	23	6	This statement can be clearer for policymakers [Government of Ireland]
5364	SPM	23	3	23	6	Suggest to extend C1 with a reference to high emission scenarios, e.g. "C1. Impacts from climate-induced changes in the ocean and cryosphere challenge, the adaptive capacity of societies and ecosystems as well as their governance to address increasing and residual risks across local, regional, national, and international levels, especially if high emissions continue (high confidence). [Government of Germany]
8678	SPM	23	3	23	6	Please add a sentence about the fact that vulnerable human communities may face adaptation limits well before the end of this century, even under low emission scenarios (see C1.3, page 23, line 28-32). [Government of Netherlands]
8714	SPM	23	3	23	6	C1: Other stressors are not included in this Section, these stressors are important because they may exacerbate the adverse climate induced impacts. Other stressors need to be included/considered as well in this statement [Government of Kiribati]
3036	SPM	23	3	28	31	There is a considerable focus on coastal communities and impacts of sea-level rise in Section C. C4.1 and C4.2 focus on Arctic and high mountain communities, but this seems insufficient elsewhere in this section given the challenges that ice mass/permafrost loss will raise for communities e.g. increased risk of natural hazards such as glacial lake outburst floods and land subsidence. These are mentioned consistently elsewhere in section A and B of the SPM and throughout the underlying report (e.g. Executive Summary of Chapter 2) so suggest that these recieve greater focus in the challenges/options of Section C. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7254	SPM	23	4	23	4	The use of "governance" is unclear and potentially overly narrow here. Suggest changing to say "as well as their CAPACITIES AND FRAMEWORKS FOR ADDRESSING increasing and residual risks..." [Government of United States of America]
3574	SPM	23	4	23	5	Delete "...as well as their governance to address increasing and residual risks across local, regional, national and international levels". Replace with "and require adequate governance structures across all levels to address increasing and residual risks." [Government of Brazil]
8680	SPM	23	7	23	8	Also add icon Seal Level Rise and Coasts to paragraph C1.1. [Government of Netherlands]
7258	SPM	23	8	23	10	The use of "are often" suggests that a large sample size of governance systems has been observed and analyzed over a significant period of time in order to determine the suitability of current governance systems to manage the scale of spatial and temporal climate changes. Is this the case? If it is not the case and research is not so advanced in this area, this statement should be reframed. [Government of United States of America]
3384	SPM	23	8	23	13	This entire section contains several examples of inappropriate use of confidence language. In this case, a list of examples is given 'medium confidence'. There is no assessment or judgement being applied here -- the either are or are not examples -- it is recommended that the 'medium confidence' qualifier be removed. [Government of Canada]
3628	SPM	23	8	23	13	It is important to highlight the unique challenges that SIDS such as Nauru are facing, also including the lack of and need for more regional scientific assessments. [Government of Nauru]
970	SPM	23	8	23	14	C1.1 speaks to governace structures not being matched to spatial and temporal impacts of climate change and gives examples including high mountain and polar regions but fails to mention Small Island Developing states. Sea level rise should also be included as one of the risks. [Government of Jamaica]
1506	SPM	23	8	23	14	C1.1 Small Island Developing states should be included in the examples section. Also, sea level rise should also be mentioned as one of the risks. [Government of Saint Kitts and Nevis]
5366	SPM	23	8	23	14	The following para should be added in C1.1: "Societies will be exposed, and challenged to adapt, to changes in the ocean and cryosphere even if current and future efforts to reduce greenhouse gas emissions keep global warming well below 2°C (very high confidence)." Source: Technical Summary, P9. Rationale: The sentence adds the still missing link to ambitious mitigation and the need for action. [Government of Germany]
7260	SPM	23	8	23	14	It would help to explain this statement more. What does it mean that current governance structures are not well-matched? (Do authors mean, for example, that elected officials often are not incentivized to plan much beyond their term in office, so there is short-term planning when we need a lot more long-term planning?) [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7262	SPM	23	8	23	14	A key example of possible mismatched governance is managing fish stocks within a region or geographic area pending shifting stock distributions. [Government of United States of America]
5368	SPM	23	8	23	24	The statements referring to governance being "not well matched" or "fragmented" in C1.1 and C1.2 are very important however rather unspecific. It would be appreciated if these important findings could be formulated in a less generic way, to clarify the challenges, as e.g. in C1.2 line 18 "The capacity of governance...", which is a valid statement and assessment, and related to specific actors. [Government of Germany]
8196	SPM	23	8	23	34	The data requirements for planning proper adaptation measures can also be included for more clarity [Government of India]
7256	SPM	23	8	23	8	The term "governance structures" is unclear. Suggest a more specific reference that gets more specifically at what is being referenced so that the reader can understand what is meant -- for example, replace "governance structures" with "environmental governance frameworks". [Government of United States of America]
8096	SPM	23	8	23	8	All four icons at the beginning of C1.1 should be coloured. [European Union]
1564	SPM	23	8	23	9	The Sentence " The Current Governance Structures are not ..." We think need more clarity on what is the message here. We are afraid it is policy prescriptive [Government of United Republic of Tanzania]
988	SPM	23	8	24	21	Coast legend needs to be included. [Government of Jamaica]
1524	SPM	23	8	24	21	Please include coast in the legend [Government of Saint Kitts and Nevis]
7264	SPM	23	10	23	10	"...create barriers THAT challenge..." [Government of United States of America]
7266	SPM	23	10	23	10	Reorder words to say "Such mismatches create barriers that can challenge the ability ..." [Government of United States of America]
7268	SPM	23	11	23	13	Sea level rise also needs to be mentioned. U.S. examples include: Florida with limestone geology, New Orleans starting out well below sea level, the low lying land around Chesapeake Bay, the Sacramento-San Joaquin delta with its many so-called islands that are far below river level (called "empty reservoirs" that are essential to sustaining the California freshwater resource system). There are similar problems in many countries around the world. [Government of United States of America]
3576	SPM	23	12	23	13	Delete "renewable resource management and biodiversity protection options in polar regions," [Government of Brazil]
7270	SPM	23	16	23	16	Strike "in many contexts". It is safe to say that governance systems are too fragmented across administrative boundaries. [Government of United States of America]
766	SPM	23	16	23	17	Consider to add political ("across administrative an political boundaries") and/or replace administrative by jurisdictions for legal acccurancy. [Government of France]
3578	SPM	23	16	23	18	Delete "Current governance systems are, in many contexts, too fragmented across administrative boundaries and sectors to address the increasing and cascading risks from changes in the ocean and cryosphere in an integrated way (high confidence)." [Government of Brazil]
972	SPM	23	16	23	24	C1.2 has a similar issue of Small Island Developing States not being included [Government of Jamaica]
1508	SPM	23	16	23	24	C1.2 Rquest to include Small Island Developing States in this section as well. [Government of Saint Kitts and Nevis]
8098	SPM	23	18	23	19	"The capacity of governance systems [...] to respond [...] has strengthened" : Is it valid to all regions? Some examples would be useful to underpin the confidence rating. [European Union]
1140	SPM	23	20			Suggest deleting jargon: "Actors". [Government of Australia]
7272	SPM	23	20	23	20	Whose "actors"? [Government of United States of America]
7274	SPM	23	21	23	21	Revise to read "...coordinating responses to the IMPACTS OF climate change." [Government of United States of America]
974	SPM	23	26	23	34	C1.3 Strongly agree with this bullet and believes it adds to the message being sent however the inclusion of Small Island Developing States is needed. [Government of Jamaica]
1378	SPM	23	26	23	34	The concept of "adaption limits" needs to be put into context in this section. It should reflect that potential limits of local adaptation measures strongly depend on the scenario considered and the context-specific risk tolerance. [Government of Luxembourg]
1510	SPM	23	26	23	34	C1.3 There is full support of this bullet and strongly recommend that it is retained. It would be more useful, however, if SIDS is included. [Government of Saint Kitts and Nevis]
4168	SPM	23	26	23	34	Point C1.3 could do with some more detail in order for the reader to properly comprehend the point being made or to be useful to policy makers. 'Barriers' are mentioned twice without outlining what type of barriers are being alluded to, or without examples. Similarly, it is stated that these 'barriers' (whatever they may be) 'impede' resilience builing etc. But how/in which ways do they impede this? Please consider adding an additional explanatory sentence here. In this regard that cross chapter box 9 also contain relevant information. [Government of Norway]
7724	SPM	23	26	23	34	The barriers alluded in paragaph C1.3 should be better explained and specified. [Government of Spain]

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8100	SPM	23	26	23	34	In this point C1.3 the concept 'adaptation limits' is used with references to sections of chapters 2, 3 and 4. However, we only found the 'adaptation limits' concept in the Cross-chapter Box 9, and not in the other chapters referred here. Is there a formal definition of these 'adaptation limits' anywhere? These limits may perhaps evolve (at least to a point) depending on (e.g.) technological developments? In any case, a formal definition should be provided as otherwise the term could be misleading. [European Union]
3038	SPM	23	28	23	30	Suggest that the list of vulnerable human communities facing adaptation limits should also include low-lying coastal human communities to be consistent with B9.2 [Government of United Kingdom (of Great Britain and Northern Ireland)]
7542	SPM	23	28	23	30	This sentence is partly repetition of B9. Please, consider revising this and/or corresponding sentence in B9. [Government of Finland]
3630	SPM	23	28	23	31	This statements needs to be much more explicit about what the situation for low-lying islands will look like if adaptation limits are reached! These consequences are currently not communicated. [Government of Nauru]
7276	SPM	23	28	23	34	KEY ISSUE [JARGON]: The term "adaptation limits" is not used anywhere in the underlying chapter. Helpfully, Chapter 4 is much more specific about the various types of responses, their distinct limits, and the unique reasons for their limits. Section 4.4 outlines the different limits for responses to sea level rise, including protection, accommodation, and ecosystem-based adaptation, among others.The term "adaptation limits" is not a useful short-hand to represent the diversity and range of limits associated with the various responses. Suggest that the authors find another way to describe these limits in the SPM. [Government of United States of America]
8102	SPM	23	28	23	34	Suggest re-formulating the text text starting with "Vulnerable" as follows: "Some vulnerable communities, especially those in low-lying coastal areas, small islands, high mountains and along Arctic coasts, may face limits to adaptation well before the end of this century with current risk reduction and adaptation options and preferences, even under a low greenhouse gas emission pathway. The risk of reaching current adaptation limits could increase and expand to more geographies beyond 2100, in the absence of enhanced or new risk reduction and adaptation strategies, due to the long-term commitment of sea level rise (medium confidence). The extent of climate-related biophysical changes, the capacity of societies to overcome barriers and societies changing preferences, determine the options that are or will be technically and physically feasible, and therefore the extent of residual risks. However, determining these and their timing precisely is currently difficult. " [European Union]
7278	SPM	23	29	23	29	Change "may" to something like "will very likely" to be consistent with IPCC lexicon. [Government of United States of America]
5370	SPM	23	30	23	32	The risk of reaching adaptation limits will increase and expand to more geographies beyond 2100, due to - EXCHANGE with: "the existing inertia in the ocean and climate system" and expected impacts of sea level rise due to past anthropogenic emissions" (medium confidence). [Government of Germany]
8644	SPM	23	30	23	32	Avoid excessive eufemistic language. Replace “risk of reaching adaptation limits” = communities will not be able to adjust to change; “long-term commitment of SLR” = the continuation of SLR after 2100. Sentence would read "The risk that communities will not longer be able to adapt to the continuation of SLR after 2100 will increase and expand to more geographies". [Government of Netherlands]
3386	SPM	23	31			should commitment here be revised to something like ‘likelihood’; commitment is anthropogenic in context and seems inappropriate. [Government of Canada]
7280	SPM	23	31	23	31	The meaning of the word 'commitment' appears unclear here. 'Commitment' means "dedication to a cause or activity". Perhaps what's meant is 'trajectory'? [Government of United States of America]
8350	SPM	23	33	23	33	To be more accurate, insert "or when" after "whether" such that the sentence reads: "...determine whether or when adaptation limits will be reached" [Government of New Zealand]
3032	SPM	23	34	23	34	...is currently difficult' -can it be explained succinctly why determining adaptation limits and their timing is currently difficult? [Government of United Kingdom (of Great Britain and Northern Ireland)]
968	SPM	23	35	23	35	An additional header statement is being recommended to treat with cost of adaptation which is supported in Chapter 4. [Government of Jamaica]
1504	SPM	23	35	23	35	In an effort to support Chapter 4 and to treat cost of adaptation, it would be useful to include an additional header statement. [Government of Saint Kitts and Nevis]
994	SPM	23	35	23	40	Proposal of inclusion of sub bullet C1.4 to highlight the significant impact of the oceans on the Fisheries sector and to livelihoods in Small Island Developing States. [Government of Jamaica]
4412	SPM	23	36	23	36	This title should be more explicite. [Government of Monaco]

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Comment id	Chapter	From page	From line	To page	To line	Comment
5398	SPM	23	36	26	22	Adaptation measures (as well as mitigation measures) can have long-term consequences (lock-in phenomena) which must be considered in the identification and implementation of measures. Therefore a differentiated risk assessment is needed which looks for the specific regional scale and offers all adaptation options. Please revisit section C and revise the text in order to better represent the risk of lock-in/maladaptation. [Government of Germany]
8722	SPM	23	38		43	C2: They do not include [Government of Kiribati]
3388	SPM	23	38	23	43	Another example of inappropriate use of confidence language. In this case, a list of options is provided and given 'high confidence' -- they either are or are not options; again it is recommended that the confidence qualifier be removed. [Government of Canada]
3390	SPM	23	38	23	43	Following table 5.9 in Chapter 5 (Major Issues in Ocean Governance), there are proposed changes to address governance issues. It would be important to include these proposed changes in the Summary for Policy Makers, especially the importance of increasing the participation of Indigenous governments and Indigenous communities in decision-making [Government of Canada]
3762	SPM	23	38	23	43	This statement can be clearer for policymakers, including on options to mitigate risks throught actions on emissions [Government of Ireland]
7282	SPM	23	38	23	43	These sentences seem to seriously understate the risks to ecosystems. For example, the lodgepole pine ecosystem is already well beyond functional integrity; the hydrogeography of the upper Great Plains is just not well-suited to having the heavy precipitation that is occurring due to the warming Arctic not holding that moist air down toward the Gulf of Mexico; and aridification is already affecting southern Australia and southwestern North America. For each of these examples, the proposed approaches will not really help. Basically, there are serious risks for some ecosystems now, independent of the future scenario. [Government of United States of America]
5372	SPM	23	38	24	21	C2: The headline statement C2 lists "the reduction of pollution and other stressors" as an option to assist future functional integrity of marine and cryosphere systems. However, the subsequent detailed paragraphs on such options do not include sufficient reference to the option of addressing the non-climatic stressors in overall resilience strategies. Please add substance to the subsections concerning the reduction of pollution and other stressors. [Government of Germany]
8104	SPM	23	38	24	21	C2 - while it is useful to list response options, this section says very little about how effective these options are. For example, C2.2 says that "terrestrial and marine habitat restoration… can be locally effective". Locally effective at doing what? Can the section identify the impacts that are reduced by each measure, and ideally describe how great the reduction in impacts might be. If quantification is not possible, at least consider promoting some of the clearer statements from the underlying report, such as this one from the TS "Conservation of these habitats (mangroves, seagrasses, salt marshes) would also sustain the wide range of ecosystem services they provide and assist with climate adaptation through improving critical habitats for biodiversity, enhancing local fisheries production, and protecting coastal communities from sea level rise and storm events (high confidence)." [European Union]
8106	SPM	23	40	23	42	revise and add : Ecological, financial, institutional and governance constraints for such actions exist, but due to their potential for multiple benefits ecosystem-based approaches can be no-regret options even if their effectiveness may be compromised under high emission scenarios. rationale : the sentence as stands makes believe as if only ecosystem-based approaches will be compromised under high emission scenarios. Grey infrastructure only serves one function and needs exact figures, a dam which is not high enough may increase the disaster whereas an ecosystem eg a mangrove is more likely to reduce damage even in extreme cases. [European Union]
8694	SPM	23	40	23	43	add: physical contraints [Government of Netherlands]
3040	SPM	23	41	23	42	The phrase "the effectiveness of some…. under high-emission scenarios" could be rephrased as 'ecosystem-based adaptation approaches may be effective but only in conjunction with rapid mitigation'. This would help to emphasise the need for urgent mitigation, which is a message that currently does not come through strongly in the SPM. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7284	SPM	23	41	23	42	"may be compromised" is vague and easily misunderstood. If the effectiveness of these approaches is reduced, then say "reduced" and explain why. Currently, none of the subsections under C2 support the final sentence of the headline statement. [Government of United States of America]
5374	SPM	23	45	23	45	In C2.1 "protected areas, on land and at sea" are mentioned, however, the icon for the ocean is missing. Please add! [Government of Germany]
5376	SPM	23	45	23	45	Icons on coastal and ocean are missing [Government of Germany]
8108	SPM	23	45	23	45	All four icons at the beginning of C2.1 should be coloured. [European Union]
8110	SPM	23	45	23	45	Protected areas (and their networks) should be mentioned more prominently and earlier, as they are relevant to impacts. They should not be discussed solely under "response", as the existing protected areas were generally not set up to respond to climate change, but they do have a tangible effect in dampening climate change impacts themselves, as well as reducing aggravating anthropogenic impacts. [European Union]
8352	SPM	23	45	23	45	Consider adding the coastal icon here as the paragraph also refers to sea-level rise and coastal habitats. [Government of New Zealand]

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8428	SPM	23	45	23	45	Add the next lines "Networks of protected areas THAT COMBINE BOTH SPATIALLY RIGID AND SPATIALY FLEXIBLE REGIMES WITH CLIMATE REFUGIA, on land and at sea, help to maintain existing ecosystem services (ESPECIALLY IN POLAR REGIONS) and can also facilitate the poleward..." (based on 3.5.4.3.2). [Government of Peru]
8682	SPM	23	45	23	45	Also add icon Seal Level Rise and Coasts and icon Oceans to paragraph C2.1. [Government of Netherlands]
8268	SPM	23	45	23	47	Useful sentence for policy makers - please retain in SPM. [C2.1] [Government of New Zealand]
1498	SPM	23	45	23	49	Some aspects related to MPAs as discussed in chapter 5 may be worth mentioning here, like the necessity for improved integrated management (chapter 5, page 113 middle paragraph) or cost effectiveness (5.5.2.5). [Government of Italy]
3552	SPM	23	45	23	49	"Land use changes" can be desired ones, if they are part of adaptation such as restoring wetlands. Here, the "land use changes" could be amended to read a"land use changes that further fragment natural ecosystems". [Government of Sweden]
7726	SPM	23	45	23	49	This paragraph C2.2 should also have the ocean symbol since its deals with protected land and sea areas. [Government of Spain]
8198	SPM	23	45	24	21	A suitable framework for mapping the coastal vulnerability (if any) can be discussed [Government of India]
1462	SPM	23	47	23	48	Physical factors?? [Government of Denmark]
4414	SPM	23	47	23	49	It is not an information to put in this part on "Options". Can be deleted. [Government of Monaco]
3034	SPM	23	48	23	48	Suggested edit: '...land use change and political/territorial boundaries limit the potential..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
768	SPM	23	48	23	49	Please consider rewording "migration" as it is ambiguous [Government of France]
772	SPM	23	51	23	51	Please rephrase as "Terrestrial and marine habitat protection and restoration, and..." [Government of France]
4416	SPM	23	51	23	52	Add "Assisted evolution", a process highly discussed in different parts of the main report. What are assisted species migration in marine areas? [Government of Monaco]
770	SPM	23	51	24	4	Please mention in C2.2 that "Networks of protected areas at sea can help in mitigating and promoting adaptation to climate change (low confidence)". See sections 5.5.1 and 5.5.2 in Chapter 5. [Government of France]
3392	SPM	23	51	24	4	Actions listed in this section will be most successful when they are community-supported and, Western science and Indigenous knowledge based. It is important to state the necessity of including Indigenous knowledge. [Government of Canada]
3394	SPM	23	51	24	4	Seeking clarity/review: "Terrestrial and marine habitat restoration, and ecosystem manipulations such as assisted species migration and coral gardening, can be locally effective (high confidence)." This may be true for the localized actions that are envisioned here, but does not seem wise to attribute high confidence to the success of any ecosystem manipulation. [Government of Canada]
5378	SPM	23	51	24	4	C2.2 Coastal and marine ecosystem restoration should be treated separately from specific measures such as coral gardening, so as to avoid undue prominence of options with marginal potential. The para on coral gardening in the Technical Summary (p.32-33) is much clearer. Suggest to use formulation from the Technical Summary. An additional statement on coastal ecosystem restoration should draw on section 5.5.2.1.3 of the full report. [Government of Germany]
8112	SPM	23	51	24	4	Is there any evidence about the effectiveness of these actions beyond the local scale? [European Union]
7286	SPM	23	52	24	2	Is the statement based upon observations of the past, or projections of the future? If based upon projections, state that the actions "are projected to be... (confidence level)". [Government of United States of America]
8114	SPM	24	1	24	21	There seems to be hesitation between the use of the words habitats and ecosystems, the text should be more accurate and consistent in the use of these terms. [European Union]
774	SPM	24	1	24	3	The cost of coastal restoration operations is generally lower than the cost of constructing and maintaining a structure. This point should therefore be qualified and better balanced, even if the cost varies from one region to another and from one ecosystem to another (ex: the restoration of a mangrove is not expensive in the areas where it existed before, as it is generally necessary to replant some seeds of mangroves and it starts again in a few months / years). [Government of France]
1142	SPM	24	2	24	4	Suggest the statement on the 'effectiveness is limited to low emission scenarios' for coastal habitat restorations be clarified. There are many methods that would be resilient to higher emission scenarios. [Government of Australia]
7288	SPM	24	2	24	4	It is true that habitat restoration costs can be high (but not always), but the return of investment is the more critical factor. [Government of United States of America]

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7290	SPM	24	2	24	4	Effectiveness has not been clearly defined. Does it refer only to physical and technological feasibility, or also economic factors? Different readers may make different assumptions, and the text should be clearer on this point. Why is coastal habitat restoration less effective at higher emissions levels? [Government of United States of America]
8116	SPM	24	2	24	4	suggestion to delete: 'The cost of …. Is limited to low emission scenarios'. Rationale: The sentence as it stands is biased and potentially misleading. Many of the benefits of ecosystem-based approaches/restoration are not or cannot be costed and hence are not captured by traditonal cost benefit analysis. The benefit of restored ecosystems is orders of magnitude higher of the multiple benefits are considered. [European Union]
8118	SPM	24	2	24	4	The sentence on cost and effectiveness appears unbalanced. The cost needs to be related to relevant comparators, such as the cost of inaction, the cost of alternative measures to achieve commensurate protections. It should also take into account eventual co-benefits. It should be clarified that a unit of hectare of coastal habitat can protect multiples of that area inland, therefore the cost per area protected can be a small fraction of the cost of area restored. In any event, the cost range presented suggests that these can be among the cheapest of measures, as it is unlikely that any alternative solution (like engineered coastal protections) could cost less than "thousands". Furhtermore, it seems doubtful that coastal restoration (which often involves little more than planting mangroves or other vegetation) could not be done below the cost mentioned in many developing countries. It is also questionable whether the effectiveness is always limited to low-emission scenarios. As indicated in SPM.4, the impacts under low- and high-emission scenarios do not deviate significantly until a few decades from present, which means that in the meantime restoration could provide similar protection under all scenarios. On the longer run, high-emission scenarios may overwhelm not only ecosystem-based approaches, but also engineered solutions, so the "limited effectiveness" may apply equally. Lastly, at least some ecosystem-based solutions (but none of the engineered ones) can adapt themsleves to the changing environment (e.g., mangroves migrating to higher ground with increasing sea level). [European Union]
3042	SPM	24	3	24	3	Effectiveness is limited to low emission scenarios' - meaning such measures would be ineffective in the long-term at anything but a low emission scenario? If so, suggest this point is made explicitly here. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7292	SPM	24	3	24	3	"… ALTHOUGH its effectiveness is limited to EVEN low emission …" [Government of United States of America]
8660	SPM	24	3	24	4	What is meant with 'low emission scenarios'? Only RCP2.6 or also others? [Government of Netherlands]
4418	SPM	24	4	24	4	Add "Box 5.5" [Government of Monaco]
3396	SPM	24	6	24	11	C2.3 Avoid using the term "adaptive management" as it lacks a broadly agreed upon definition. [Government of Canada]
8730	SPM	24	6	24	11	C2.3: The question: Can authors say something on the nature of the fisheries in other regions like the Pacific Islands, since there is specific reference to Polar Fisheries region [Government of Kiribati]
3534	SPM	24	6	24	15	These two bullets might be feasible to combine into one. [Government of Sweden]
776	SPM	24	6	24	6	"precautionary approaches": Should be "ecosystem approaches". "precautionary approaches" is confusing (in Europe it is the name of a very not precautionary norm for fisheries management). "ecosystem approach" is much more appropriate. [Government of France]
3056	SPM	24	6	24	9	This line is also relevant, and important for aquaculture (ref Chapter 5, pg 114). Sugest this paragraph could also reference this too. [Government of United Kingdom (of Great Britain and Northern Ireland)]
4420	SPM	24	8	24	8	"Renewable resource economies" What does this means? [Government of Monaco]
7294	SPM	24	8	24	8	Should whales and other large animals dependent on krill be listed here as well? [Government of United States of America]
7296	SPM	24	9	24	11	Adaptive management -- i.e., management actions that are updated as (environmental and biological) conditions change or forecasts are developed -- will be increasingly necessary to effectively manage marine ecosystems subjected to increased frequency of extreme events. This strategy can and should be applied globally, not just for polar fisheries. Additionally, 'dynamic' MPAs will be more resilient to climate variability and change, with the timing of management actions linked to the scales of change in the environment. The key point is that an important option to consider now is the development of climate-ready adaptive management approaches. [Government of United States of America]
8120	SPM	24	13	24	13	Is the concept of "sustainable fisheries management" sufficiently clear in the context of the rapid and irreversible changes presented? Perhaps some explanation would be useful. [European Union]
3044	SPM	24	13	24	15	What are the implications of a catch reduction for shorter-term food security and what is the relationship between short and long-term catch yields under sustainable fisheries management? [Government of United Kingdom (of Great Britain and Northern Ireland)]
5380	SPM	24	13	24	15	C2.4: This should link to {5.5.2} of the full report, where fisheries management adaptation strategies to climate change are discussed (p.5-112 - p.5-114). [Government of Germany]

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5382	SPM	24	13	24	15	C2.4: The full report and the summary detail the impacts of climate change on fish stocks, fisheries and the associated benefits. However, in Section C where the focus is on solutions, there is very little on fish and fisheries. Based on the detailed analysis in the full report (p.5-112 - p.5-114) and particularly Table 5.8, we suggest adding at least a sentence on the possibilities provided by community-based adaptation responses and participatory processes. For example: "Community participation in decision-making and climate change adaptation is an important element to sustain the benefits from fisheries under climate change risks." [Government of Germany]
7298	SPM	24	13	24	15	Mentioning sustainable fisheries seems like an important point. Policymakers may interpet "sustainable fisheries management" to mean a lot of different practices given how many different frameworks there are for defining sustainability. [Government of United States of America]
7300	SPM	24	13	24	15	If this statement concerns projected changes, specify that they "are projected to be… (confidence level)" or "have the potential to" rather than "will…". [Government of United States of America]
7302	SPM	24	13	24	15	This statement seems far too optimistic, seeming to ignore that the optimal conditions for particular fisheries are shifting and will not be able to be restored in their traditional areas. Fisheries are shifting so much and so closely in response to change in temperature, etc., that it will be hard to gain the knowledge to manage them at all. In addition, as fisheries shift poleward due to temperature, they will run into greater ocean acidification, further complicating their health. [Government of United States of America]
8736	SPM	24	13	24	15	C2.4: Need to include additional sentence to include: 'under low emissions scenario, fisheries dependent countries are going to be adversely affected and the statement at it is now, is still not going to help retain our fisheries. This is the missing gap that is critically important for fisheries dependent countries like Kiribati, Tuvalu, and RMI [Government of Kiribati]
3580	SPM	24	17	24	17	Delete "blue carbon". Term is a political catchphrase that does not add to the description of "coastal ecosystems". [Government of Brazil]
7304	SPM	24	17	24	17	The term "coastal blue carbon ecosystems" is a bit confusing and needs to be defined. In defense circles, the coastal waters are referred to as the green part of the ocean (near-shore where life is) as opposed to the deep ocean, which is referred to as the blue ocean. So, given the changing types of security threats, navies are converting from being prepared for war in the blue ocean to being prepared to deal with coastal threats and disaster assistance in the green ocean (i.e., the coastal environment). In the use here, it would seem that "blue carbon" could just be dropped as being repetitive, or maybe substitute the word "ocean". [Government of United States of America]
8122	SPM	24	17	24	17	What is the meaning of "blue carbon ecosystems"? Are there any marine/coastal ecosystems that would not be "blue carbon"? If it refers to all marine/coastal ecosystems, then there is no added value in using the term. If "blue carbon" has some specific meaning, it should be defined and introduced earlier. Also, to the extent these ecosystems can play a part in mitigation, they can also be a significant source of emissions, which should also be mentioned for balance. Future sequestration potential is generally linked to past losses of ecosystem carbon (emissions), and continued losses can lead to continued emissions. [European Union]
8124	SPM	24	17	24	17	Suggest replacing "well-managed" with "well-protected". These system are less frequently/intensively managed than land systems, and they can largely fulfil their function as long as they are not destroyed. [European Union]
1380	SPM	24	17	24	19	Please rephrase to: Well-managed ecosystems, such as … [Government of Luxembourg]
3764	SPM	24	17	24	19	Avoid using obscure terms for policy such as "blue carbon" and refer to specific elements that are understood [Government of Ireland]
4114	SPM	24	17	24	19	The previous draft SPM described the mitigation potential of other blue carbon, such as seaweed/macroalgae, and the uncerainity of these estimates. Such conclusions are useful for blue carbon policies in countries and regions where kelp-forrests are important blue carbon ecosystem, and could be reflected in the final SMP . [Government of Norway]
6028	SPM	24	17	24	19	It is needed to include tidal flat on well-managed coastal blue carbon ecosystem. [Government of Republic of Korea]
7544	SPM	24	17	24	19	Is "for some nations" needed in this context? [Government of Finland]
5384	SPM	24	17	24	21	C2.5 highlights coastal ecosystems "blue carbon", but then qualifies that statement by referring to modest mitigation potential. Is this really the most appropriate way to frame this? In A6.1 the carbon emission associated with loss of those habitats seem to point in a different direction. Even if the potential of sequestering additional Carbon may be limited, it is still very important to prevent the loss of the carbon stock in coastal wetlands. Maybe revising the wording could guide the reader in a more constructive direction, emphasizing the co-benefits of protecting and restoring coastal ecosystems, protecting the C stock and enhancing the C sink. [Government of Germany]
6086	SPM	24	17	24	21	The report can not undermine and prejudge the continuous efforts by countries on their projects, initiatives and efforts in their coastal blue carbon ecosystems by suggesting that all those efforts is modest at the global scale! [Government of Saudi Arabia]

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7716	SPM	24	17	24	21	we ask for deletion of the words "blue carbon" in line 17 or the inclusion of a definition of this term. As far as we know there is no agreed definition. We would prefer references to "Well-managed coastal ecosystems", it is descriptive enough, it doesn't change the sense of the paragraph and it does not introduce concepts for which the IPCC doesn't have an agreed definition. In addition, we wonder what the reference to "some nations" in line 19 means… Is it only referring to those nations with coasts? this should be clarified or "for some nations" should be deleted. [Government of Spain]
8126	SPM	24	17	24	21	The sentence on line 20-21 seems to undermine the sentence from line 17 to 19. This is probably not the intention. Hence the need to refer to the mitigation potential at global level of some coastal areas which represent a very limited surface of the earth may be misleading. Moreover, the adaptation potential of "blue carbon" ecosystems is not referred to in this paragraph althout is it a relevant characteristic of such ecosystems [European Union]
8128	SPM	24	17	24	21	Delete last sentence: overall, to a policy maker it would give the feeling that restoring and reinforcing marine and coastal ecosystems will have a low impact. This may be true in absolute terms for mitigation. However, not necesarily in relative terms (abatement cost, or in comparison with some land options like bioenergy) and it offers substantial adaptation and other benefits. Coastal coast protection and other ecosystem services remain valuable and worth committing to, as stated in several parts of the report. [European Union]
8190	SPM	24	17	24	21	The idea of blue economy (Atmanand et al. 2018), which envisages the sustainable utilization of ocean resources in view of climate change may be proposed as a sustainable measure along with their proposed measures which can be included in the chapter. Reference: M. A. Atmanand et al. Blue Economy of India and Technology Initiatives II, Marine Technology Society Society Journal, Volume 52, Number 5, 2018. [Government of India]
8354	SPM	24	17	24	21	Instead of "contribute to climate mitigation for some countries" it would be better to keep the statement high-level. While there might be potential for nations to count the carbon dioxide removals that occur in coastal ecosystems, in the IPCC's GHG inventory methodological good practice approach it is the anthropogenic emissions and removals that are of interest i.e. the positive and negative effects of human activities. The existence of these ecosystems and the human impact on them does have an impact on what the atmosphere receives in terms of greenhouse gases, but it is not clear that the mitigation potential referred to here is the result of addtional activities or a reflection of the status quo. Never-the-less it is important to reflect that well managed coastal ecosystems (don't need to use the term "blue carbon") contribute to managing/addressing climate change as well as other environmental issues. Suggest ending this sentence "…and contribute to global climate mitigation through their uptake and storage of carbon." [Government of New Zealand]
8648	SPM	24	17	24	21	Suggestion to split mitigation from other positive contributions. Paragraph would read "Well-managed coastal blue carbon ecosystems, such as mangroves, tidal marshes and seagrass meadows, provide coastal protection, reduce eutrophication, and support fisheries. They also contribute to climate mitigation for some nations through their uptake and storage of carbon (high confidence). However, their mitigation potential is relatively modest at the global scale (offset of <2% of current emissions) (medium confidence)." [Government of Netherlands]
8130	SPM	24	18			Insert "and aquaculture" after "fisheries" to read: "fisheries and aquaculture," [European Union]
3582	SPM	24	18	24	29	Delete "contribute to climate mitigation for some nations through their uptake and storage of carbon (high confidence)." Replace with "may represent a relevant carbon sink and reservoir." The environmental integrity of coastal ecosystems mitigation strategies is questionable since it is not yet clear if the carbon sequestered would be treated as offsets for fossil fuel emissions. [Government of Brazil]
3058	SPM	24	20	24	20	Where does the figure "<2%" come from? In 5.5.1 we find "Mitigation through emission reduction can therefore be achieved by habitat protection, to greatly reduce or end the human-driven loss of mangrove, saltmarsh and seagrass ecosystems. Such action could potentially produce nationally-significant mitigation (>1% of fossil fuel emissions) for several countries" [Government of United Kingdom (of Great Britain and Northern Ireland)]
8132	SPM	24	20	24	20	Replace "offset of" with "equivalent to" or "commensurate with". "Offsetting" implies policy choices and a commitment regime within which obligations/commitments in certain places/sectors can be replaced by additional efforts made elsewhere. It is clear that for ambitious mitigation outcomes all sectors and regions should contribute. In that context, there is no reason to assume that mitigation efforts in coastal ecosystems could "offset" emissions elsewhere any more than mitigation elsewhere (in other sectors) could "offset" emissions from ecosystems. [European Union]

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4138	SPM	24	20	24	21	Please consider changing this sentence to include references to uncertainties related to mitigation through coastal blue carbon and potential co-benefits in terms of adptation, for example: "There are still several complexities and uncertianties relating to the mitigation role of coastal blue carbon ecosystems, however well-managed coastal ecosystems may also provide the co-benefit of providing coastal communities with regulating services that can contribute to climate change adaptation, such as reduced storm impact and protection from coastal erosion." or something similar. See chapter 5.4.1.2, in addition to the last section in 5.5.1.2.2 for broader societal benefits, where it says: "there is high confidence that coastal wetlands benefit local fisheries, enhance biodiversity, give storm protection, reduce coastal erosion, improve water quality, and support local livelihoods", and 5.5.2.1.3. [Government of Norway]
7306	SPM	24	20	24	21	What is the confidence and effect at the local level. It could be effective to add in at least an average for how much coral reef communties could be effected. Will tourism/ other industries benefit from effective management solutions and therefore promote economic stability? [Government of United States of America]
8134	SPM	24	20	24	21	suggestion to delete: nevertheless, their mitigation potential … emissions). Rationale: the added value of the sentence is not clear. Again the strength of blue carbon, mangroves etc … lies in their multiple benefits. Mitigation is one of many. [European Union]
5386	SPM	24	21	24	21	Please consider to add the following text from chapter 5 as a new bullet C2.6, or as bullet in a potential new mitigation section (cf. our comment "mitigation"). "Because of the many technical, environmental and governance issues ocean-based mitigation solutions (limited to the management of natural processes) beyond the coastal zone, are not a viable mitigation measure. Natural processes per se, although important to the climate system and the global carbon cycle, are not a mitigation response. Other opportunities to reduce emissions from blue economy sectors, such as a greater use of ocean renewable energy or reductions from emissions from shipping, exist." (see report section 5.5.1) [Government of Germany]
4148	SPM	24	22	24	22	Considering that there is a risk of loosing 20-90% of coastal wetlands -- would it be possible to include a statement about options to protect/restore these ecosystems? E.g. by reducing other stress factors. [Government of Norway]
5388	SPM	24	23			Please include this important finding from Chapter 4-ES (p.3) "Adaptation can be undertaken in the short- to medium-term by targeting local drivers of exposure and vulnerability, notwithstanding uncertainty about local SLR impacts in coming decades and beyond (high confidence)." in section C3; [Government of Germany]
7308	SPM	24	23	24	23	Need to change "associated extreme events" to something like "the greater inundations and damage that increasingly extreme weather will induce". [Government of United States of America]
4150	SPM	24	23	24	27	The draft SPM does not mention disaster risk management e.g. the integration of disaster risk management and climate change adaptation. Consider including this aspect here. See last finding at page TS-37. This is relevant to extreme events. [Government of Norway]
6088	SPM	24	23	24	27	What are these available options and what cost and trade-offs that we talking about? maybe useful to explore, analyze and assess these options prior to making any decision. [Government of Saudi Arabia]
8684	SPM	24	23	24	27	Please add a sentence about coastal decisions favouring flexible responses, periodically adjusting decisions, and that for stakeholders who have a low risk tolerance it is beneficial to consider sea level rise above the likely range of RCP8.5 (see C3.4, page 25, line 1-60. [Government of Netherlands]
8696	SPM	24	23	24	27	Text of C3 is very general. Add first sentence of 3.1 to C3. Add to C1: However, economic and social barriers may be faced well before such limits are reached. Even with full adaptation some areas, particularly urban atoll islands and arctic communities, face high risks by 2100 under high emission pathways (RCP 8.6). [Government of Netherlands]
8738	SPM	24	23	24	27	C3: Coastal societies - this needs to be very specific to include low lying atoll nations [Government of Kiribati]
3052	SPM	24	23	24	43	This section contains several references to cross-chapter box 9 but this box now appears to be missing from the underlying report. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7310	SPM	24	24	24	24	Strike "carefully". Coastal societies do not need to necessarily "carefully" balance costs, benefits, etc. They face challenging but unavoidable choices, but how they decide to respond may not be particularly careful. [Government of United States of America]
8356	SPM	24	24	24	24	Is "negotiating" the right word here? Who are coastal societies negotiating with? [Government of New Zealand]
8358	SPM	24	25	24	25	insert "that" before "can be adjusted over time" [Government of New Zealand]

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5390	SPM	24	27	24	27	The SPM refers to section 6.9.1 with view to existing conflict resolution approaches. The paper cited in 6.9.1, p 58 discusses the history of proposals for an international compensation mechanism led by AOSIS, and potential benefits of such an international mechanism. As the introductory sentence of the paragraph reads "under the same L&D mechanism," the sentence "A compensation mechanism for low-lying small islands inclusive of L&D proposal is in progress (Adelman, 2016)" is ambiguous. Rephrasing to an active sentence, including which stakeholders are suggesting/working on a compensation mechanism, would bring more clarity, delimiting the compensation mechanism from the WIM. It is important to make clear that the WIM is not developing any compensation mechanism, as this would be outside of its mandate, given that compensation is excluded by Paragraph 51 of 1/CP.21. In addition, the delimitation of the proposal of insurance products ("Several forms of 'climate change' insurance have been proposed recently," second sentence of the paragraph) from the WIM is recommended. We suggest to adjust the introductory sentence of the paragraph. [Government of Germany]
7570	SPM	24	29			What is meant with "hard coastal protection"? It is not clear what it means. Could it be explained? [Government of Finland]
146	SPM	24	29	24	30	The following wording is suggested in order to enhance clarity: .. Will generally not be reachjed under low emission scenarios (RCP2.6), but are expected to be reached after 2100 under high emission scenarios (RCP8.5) [Government of Austria]
7312	SPM	24	29	24	30	Sea level rise does not affect coasts independently of other processes. Instead of "will generally" in line 29, consider the word "may". [Government of United States of America]
864	SPM	24	29	24	36	Please rewrite these sentences in a more balanced way. 1.« Technical limits to hard coastal protection will generally not be reached under low emissions (RCP2.6) »: Reading the report, this sentence is talking about Netherlands and Japan only, where the protections were drastically raised. But in a lot of places, even with a low emissions scenario, technical limits can be reached. Please rephrase. We could suggest ""The higher and faster sea-level rise, the more challenging hard coastal protection will be, mainly due to economic and social limits rather than to technical ones." (p.4-90, 4.4.2.2.4). 2. Please highlight the complementarity of the approaches. It is not either hard coastal protection, nature-based solutions or recomposition. It is a panel of solutions that must be apprehended globally and in a complementary way (not alternative). It is by considering them in an alternative way that one can meet obstacles. It would also qualify this point stating that, conceived as a complementary solution to protection works, nature-based solutions can overcome economic and social obstacles and be considered technically and economically viable options. [Government of France]
978	SPM	24	29	24	36	C3.1 needs to state that financial and technical barriers will exist for hard coastal protection and ecosystem-based protection as well. [Government of Jamaica]
1514	SPM	24	29	24	36	It is important that C3.1 highlights that financial and technical barriers will exist for hard coastal protection and ecosystem-based protection as well. [Government of Saint Kitts and Nevis]
3632	SPM	24	29	24	36	This paragraph must also cover financial limits and barriers for both hard coastal protection and ecosystem-based adaptation, as some of these limits are already being reached today in particularly vulnerable regions like the Pacific and in many SIDS in the region and beyond. [Government of Nauru]
8136	SPM	24	29	24	36	C3.1 and in Fig. SPM.5: Include that technical measures have less adaptive capacity than ecosystem-based adaptation, and that ecosystem-based solution can be more cost-effective and achievable than purely technical solutions in developing countries [European Union]
3536	SPM	24	30	24	30	"After 2100" is rather unspecific. When, more exactly? To what degree? Where in the world? What happens under the intermediate scenarios? [Government of Sweden]
7314	SPM	24	31	24	32	"hard protection is a cost-efficient response option" seems overly definitive. Perhaps "may be" or "is likely to be". [Government of United States of America]
858	SPM	24	32	24	32	", but governments": Please modify into " as long as effective maintenance can be ensured. In resource-limited areas, governments" The words added come from 4.4.2.2.6. [Government of France]
8746	SPM	24	32	24	32	C3.1: need to change 'may' (second last word on line 32) to 'will' (so it reads...governments in resource limited areas 'will' be) [Government of Kiribati]
7316	SPM	24	33	24	34	Authors may wish to add more language about the benefits and challenges of ecosystem-based adaptation. [Government of United States of America]
8270	SPM	24	33	24	34	Useful sentence for policy makers - please retain in SPM. [C3.1] [Government of New Zealand]
3050	SPM	24	33	24	36	Please clarify what is meant by ecosystem adaptation in the context of adapting to sea level rise. Please also clarify what the biophysical limtations are as policy makers are unlikely to be familiar with these terms. [Government of United Kingdom (of Great Britain and Northern Ireland)]
860	SPM	24	34	24	34	"other benefits": Please highlight some of those benefits. [Government of France]
862	SPM	24	34	24	34	"Biophysical limits to ecosystem-based": Please add "certain" [ecosystem-based adaptation...] [Government of France]

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8138	SPM	24	34	24	36	The sentence is unclear: ["Biophysical limits to ecosystem-based adaptation may manifest in the 21st Century but economic and social barriers may be faced well before"] – addressing at the same time what seems to be hard limits of ecosystems based adaptation and barriers of social and economic nature that could be overcome. Moreover, not clear if these barriers refer specifically to the implementation of EBA? Suggest removing the sentence.If retained, could be clarified as follows: "While biophysical limits to ecosystem-based adaptation may manifest in the 21st Century, economic and social barriers to their implementation may also exist, requiring societal changes for their effective overcoming." [European Union]
3538	SPM	24	35	24	35	This sounds now as if economic and social barriers may be faced before the 21st Century"... whereas the idea probably is that such barriers will be the first to be encountered, before biophysical limits are reached (during the 21st C). [Government of Sweden]
7318	SPM	24	35	24	35	"may" is not in the IPCC lexicon. Both could be changed to "will likely" or something similar. Ecosystems are complex and do not simply all shift together. [Government of United States of America]
778	SPM	24	38	24	38	Please add ", emergency planning" after "buildings". [Government of France]
780	SPM	24	38	24	38	Please add "is currently a widespread adaptation option. This kind of response" [is often...] after "early warning systems". [Government of France]
8360	SPM	24	38	24	38	To avoid confusion, change the order to: "Accommodation, such as early warning systems and flood proofing buildings, is often..." (otherwise it sounds like early warning systems are to be flood-proofed) [Government of New Zealand]
3054	SPM	24	38	24	40	These two sentences are confusing and it's difficult to understand what point is being made. E.g. limits to what? Soft protection? Please revise for clarity. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3766	SPM	24	38	24	40	Accommodation may have mutiple meanings, could another word be used for this collective? [Government of Ireland]
980	SPM	24	38	24	43	C3.2 mentions retreat as an adaptation option and we strongly want to state our disagreement with this statement which could also be seen as disrespectful especially to Small Island Developing States. [Government of Jamaica]
1516	SPM	24	38	24	43	C3.2 mentions retreat as an adaptation and this is not acceptable. There is limited space as SIDS and this is NOT an option for most SIDS. [Government of Saint Kitts and Nevis]
782	SPM	24	39	24	39	"particularly in low-density areas": Modify to "in all contexts". This is what the report says. [Government of France]
3048	SPM	24	39	24	39	Why in 'low density areas' rather than high? Would cost efficiency would be greater if more people were protected (i.e the area was high density)? [Government of United Kingdom (of Great Britain and Northern Ireland)]
4604	SPM	24	39	24	39	"limits are expected to arise": limits of what? Limits of 'soft' technical adaptation as opposed to 'hard' (see further) ? [Government of Belgium]
3046	SPM	24	39	24	40	This sentence needs to be clarified a little. What limits does this refer to? [Government of United Kingdom (of Great Britain and Northern Ireland)]
8140	SPM	24	39	24	40	Not clear what is the level of confidence of this sentence ["Limits are expected..."]? If low, suggest removing. If medium/high, suggest rephrasing: With current efforts, knowledge and preferences, limits are expected to arise well before those associated with hard protection. [European Union]
7320	SPM	24	39	24	43	The first sentence is quite optimistic. While it is likely a valid statement for some types of buildings (e.g., homes), but very difficult for significant infrastucture (like hospitals), there needs to be a recommendation that significant infrastructure should simply not be built in areas below several meters above recorded extreme high sea levels. In New York City, the cost of protecting buildings is involving moving critical equipment that is often heavy from below ground level to above the second floor, so to levels of the building not designed for such heavy infrastructure. Suggesting this is low cost is simply not the case. The statement needs revision and qualification. [Government of United States of America]
3634	SPM	24	40	24	42	The treatment of retreat is not acceptable and has to be presented in a much more nuanced fashion. You are talking about the relocation of people that are deeply connected to their regions. Many islands do not have "safe" areas to retreat to and retreat is not an option. "Socially, culturally and politically challenging" is not appropriate language in this context. Also, the authors need to be much more specific which regions are meant here. Furthermore, the financial perspective (who will pay?) is fully ignored, this information has to be added. It has to be clear that retreat is an adaptation form based on loss and damage, and is not an option for many SIDS. [Government of Nauru]
7518	SPM	24	40	24	43	There is inconsistency in the description for confidence between the last sentence of SPM C3.2 (“high confidence”), Figure SPM.5 (“very high confidence”), the Executive Summary of chapter 4 (“…retreat may be especially effective…”, page 6) and the underlying chapter 4 (“very high confidence”, page 102). [Government of Japan]
784	SPM	24	41	24	42	"retreat": Please reword "is especially effective" by "is effective where possible" [Government of France]
4422	SPM	24	41	24	42	Retreat can not be presented as an effective solution against sea-level rise in low-lying island context. It is not politically acceptable. Moreover it does not well represent 4.4.2.6: the effectiveness is very quickly noted, while relocation is a real issue, as well as other migration drawbacks, costs etc. [Government of Monaco]

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7322	SPM	24	41	24	43	This key message is very poorly written. Limits to retreat are not well understood? [Government of United States of America]
5392	SPM	24	42			"Where coastal risks are already high and total population and population density are low, or in the aftermath of a disaster, retreat is especially effective, albeit socially, culturally and politically challenging (high confidence)." sounds rather cynical. Please reformulate "...retreat might be technically and economically effective ..." [Government of Germany]
786	SPM	24	42	24	43	"Limits to retreat are not well understood.": Please rephrase as "Societal limits to retreat are uncertain, reflecting research gaps." [Government of France]
3540	SPM	24	42	24	43	"Limits to retreat are not well understood." does not say very much. Could it be developed a bit, or perhaps omitted, if appropriate. Please refer also to Figure SPM.5, panel c, where at least effectiveness is known with high confidence level. [Government of Sweden]
7324	SPM	24	42	24	43	The authors should consider using "barriers to relocation efforts" in place of "limits to retreat." This will allow for a space to describe the multifactorial decisionmaking related to human movement, including relocation and displacement. [Government of United States of America]
8142	SPM	24	42	24	43	The sentence "limits to retreat are not well understood" seems to undermine the previous sentences of the paragraph. As such issue is very relevant to policy-makers and somewhat sensitive, the message that should come accross this whole paragraph (from line 38 to 43) should be clarified. [European Union]
7718	SPM	24	43	24	43	confidence level for the last statement of this paragraph is missing [Government of Spain]
8246	SPM	24	45	24	45	present [Government of Austria]
5394	SPM	24	45	24	48	C3.3 Responses to sea-level rise presents society with profound governance challenges, resulting from the large uncertainty about future sea level rise INSERT "between low and high emission scenarios", vexing trade-offs between societal goals (e.g. safety, conservation, economic development), limited resources, and conflicting interests and values among diverse stakeholders (high confidence). [Government of Germany]
3398	SPM	24	45	24	51	In addition to using locally appropriate combinations of decision analysis, decision making must use diverse knowledge systems including Indigenous knowledge. [Government of Canada]
8144	SPM	24	45	51	24	Suggest deleting paragraph C3.3 as there is little new information or details as to options for adapting to sea level rise. Besides, the subsequent paragraph (C3.4) provides more concrete options and details. [European Union]
5396	SPM	24	46	24	46	C3.3: In the sentence "resulting from the large uncertainty about future sea level rise" suggest to add "...about the magnitude and rate of future sea level rise". Otherwise it might be misunderstood whether sea level rise is uncertain in general. [Government of Germany]
7326	SPM	24	46	24	46	It needs to be clarified that uncertainties include the amount, timing, and ongoing nature of sea level rise to well beyond the time that global average temperature might be stabilized. And, in doing this, it needs to be made clear that quite plausible worst cases could include rates of sea level rise of even several meters of rise per century in coming centuries (so beyond 2100) -- and that the commitment to such rates is being made now. [Government of United States of America]
8146	SPM	24	47	24	48	Include "inter-generational equity" among the goals/values listed. [European Union]
7328	SPM	24	48	24	48	"These challenges can be addressed" implies that these profound challenges can be solved using the listed approaches. More likely that the challenges can be eased or may be addressed. Suggest a less definitive statement. [Government of United States of America]
4606	SPM	24	48	24	50	We wonder whether the 'profound governance challenges' referred to in the first part of this section, can really be solved with the rather 'soft' options listed here. The real discussions are about new socio-economic models and rethinking societies. The profound challenges are mostly based on inequality - and probably increasingly so in the future as it appears from this very same summary for policymakers. [Government of Belgium]
7330	SPM	24	48	24	51	This is a huge understatement of the societal complications of such decisions. There are few cases where such adjustments have taken place before disasters have struck and made clear that what is being suggested actually can change. Just consider all the people still living in areas that have flooded or been inundated in the past. Saying "can be addressed" is just not the right phrasing. Perhaps add "with considerable societal and political challenges and resistance" as it is really hard to be proactive, with people having lessening confidence in scientific projections the closer they hit to their interests. [Government of United States of America]
7520	SPM	24	48	24	51	There is inconsistency in the description for confidence between the last sentence of SPM C3.3 (“medium confidence”), the last sentence of SPM C3 (“high confidence”) and the Executive Summary of underlying chapter 4 (“high confidence”). [Government of Japan]
8430	SPM	24	48	24	51	"These challenges can be addressed using locally appropriate combinations of decision analysis, land-use planning, public participation, equity and conflict resolution approaches that are adjusted over time as circumstances change (medium confidence). {Cross-Chapter Box 5 in Chapter 1, 4.4.3, 4.4.4, 6.9}" [Government of Peru]

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5492	SPM	24	52	25	10	Information on adaptation costs is of great interest to policy makers. The SPM does not include information on the costs of sea level rise, which is why we ask to include an additional paragraph 3.5 to cover those topics. From the ES of Chapter 4: "Effective protection requires investments on the order of tens to several hundreds of billions of US$ per year globally (high confidence). While investments are generally cost efficient for densely populated and urban areas (high confidence), rural and poorer areas will be challenged to afford such investments with relative annual costs for some small island states amounting to several percent of GDP (high confidence). Even with well-designed hard protection, the risk of possibly disastrous consequences in the event of failure of defenses remains" [Government of Saint Kitts and Nevis]
148	SPM	25	0			figure SPM.5, panel b: It is suggested to provide a narrative for the column "total adaptation and mitigation benefit" [Government of Austria]
1382	SPM	25	0			Figure SPM.5: The indication of "ranges of relative sea level rise across case studies" is not relevant for policymakers and complicates panel (a) of this figure too much. We thus recommend removing it. [Government of Luxembourg]
1384	SPM	25	0			Figure SPM.5: It is strange that risks levels are all white below present day level. Does it mean that risks are still undetectable? This seems not be in line with the text of the SPM [Government of Luxembourg]
4424	SPM	25	0	25		It is difficult to read. Are difficult to read: Figure should not be jointed as a unique block. For clarity, legends should be under the figure they refer to. a) Dashes ; What is the difference between moderate and high adaptation? b) Graphs and arrow ; The total adaptation and mitigation benefit bar [Government of Monaco]
8152	SPM	25	0	25		Figure SPM5: Panel b of the figure mentions total adaptation + mitigation benefit. However, it is difficult to understand the mitigation contribution since the legend refers only to adaptation. Also the RFC diagrams in this panel are very confusing. The y-axis refers to mit/ad benefit? Except the righ-hand RFC which refers to risk - and left-hand RFC refers to what? [European Union]
8740	SPM	25	0	25		C3.4: [Government of Kiribati]
1220	SPM	25	0	26		Figure SPM.5, which is too complex to be understood by policymakers, is suggested to be modified for an easier accessibility. [Government of China]
7546	SPM	25	0	26		Caption includes acronym RSL although it is not used, please, consider removing RSL. Concept "time gained" may be useful but needs some explanation and modifications in panel b). Adaptation gains time, i.e. moves meeting a "certain risk level" forward in time, e.g. from present some decades ahead. In panel b) the arrows showing "time gained" start from 2100 and move backward in time, which is confusing. Green line showing total benefit in b) provides little extra and should be removed to simplify figure. [Government of Finland]
8148	SPM	25	1	25	10	C3.4 - Consider bringing in the statement from the TS describing the potential contribution of adaptation pathway analysis. This is an intuitively logical piece of policy-relevant advice. However, the statement that sea level rise above the likely range should be considered "by stakeholders who have a low risk tolerance" is somewhat troubling. Is 'delegating' the issue to the risk preference of stakeholders really the best advice that science can offer at this time? [European Union]
3400	SPM	25	1	25	5	It is important to specifiy that 'expert judgement' and 'multiple lines of evidence' must include Indigenous and local knowledge. [Government of Canada]
3770	SPM	25	1	25	9	RCP8.5 could be referred to as business as usual high emissions scenario [Government of Ireland]
6090	SPM	25	1	25	9	This para. again confuses policy makers by admitting that there are large uncertainties about future sea level rise!! [Government of Saudi Arabia]
8272	SPM	25	1	25	9	Useful paragraph for policy makers - please retain in SPM. [C3.4] [Government of New Zealand]
8150	SPM	25	1	26	21	Panel (b) of figure SPM.5 is difficult to understand and hence interprete univoquely. The added value of this section of SPM5 is questionnable from a policy-relevance view point. [European Union]
1406	SPM	25	5	25	5	"For stakeholders who have a low risk tolerance, it is beneficial to consider sea leve lrise about the likely range of RCP8.5 (i.e. above 1.10 m by 2100)" This is a very important message. The message that 110 cm is the likely upper range for rcp8.5 in 2100 might be given slightly better placement than in a parenthesis with an "i.e." in front. Suggest to delete the paranthesis and the "i.e." or otherwise give emphasize to that part of the statement. [Government of Denmark]

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822	SPM	25	5	25	6	Please modify into : "The range that needs to be considered for planning and implementing coastal responses depends on the risk tolerance of stakeholders. If they are risk tolerant, they may prefer to use the likely ranges of RCP 2.6 and RCP 8.5, while if they have a low risk tolerance, they may also consider sea level rise above this range." Extracted and summarized from chapter4, p.9. [Government of France]
3066	SPM	25	5	25	6	It is not clear what is meant by 'low risk tolerance' and what the benefits of considering SLR above the RCP 8.5 range are. Suggest the text is amended to define/explain these points. [Government of United Kingdom (of Great Britain and Northern Ireland)]
998	SPM	25	6	25	6	For the bracketed section which mentions "above 1.10 m by 2100" is not clear as no temperature is provided in order to contextualise the statement. [Government of Jamaica]
1532	SPM	25	6	25	6	A temperature should be provided in order to the section that speaks to "above 1.10 m by 2100". As written it is not clear. [Government of Saint Kitts and Nevis]
3542	SPM	25	6	25	7	It is unclear what the "high confidence" refers to. It would seem to read that it refers to the "beneficial", which perhaps is not the case, and such "benefits" not assessed as such. Is the "beneficial" a result of the assessment? (RCP8.5 is a constructed case without a probablility, and the high conceivable sea level rises might be less, or more, than under RCP8.5...) [Government of Sweden]
996	SPM	25	8	25	8	C3.4 Remove "without" and replace with "despite". Figure SPM 5C highlights the drawbacks associated with hard protection adaptation in response to sea level rise. [Government of Jamaica]
1530	SPM	25	8	25	8	In C3.5, kindly delete "without" and replace with "despite". [Government of Saint Kitts and Nevis]
7332	SPM	25	8	25	8	The only effective response to the "high-end sea level rise scenarios" (so several meters per century or more) is quite rapid retreat and relocation, which cannot be deemed "effective adaptation". [Government of United States of America]
3636	SPM	25	10			Figure SPM.5 needs to be simplified so that decision makers can understand and develop resilience with a better understanding of adaptation science. The current concept of adaptation benefits is much to simplistic an therefore misleading and should be removed entirely. [Government of Nauru]
964	SPM	25	10	25	11	Fibure 5A Burning embers figure is overloaded and unclear and should not include adaptation options as historically burning embers figures are not usually given that way ad figure does not include limits to adaptation. [Government of Jamaica]
966	SPM	25	10	25	11	Figure 5B does not consider limits to adaptation and is implying that adaptation is possible with full financial and technical support which is unrealistic. [Government of Jamaica]
1500	SPM	25	10	25	11	Fibure 5A Historically burning embers do no include limits to adaptation. The figure as outlined is not clear and can be confusing to Policy Makers. [Government of Saint Kitts and Nevis]
1502	SPM	25	10	25	11	Figure 5B as outlined can be misleading and suggets that access to finances and technical support that all adapation is possible. This is notthe case. Despite access to resources, there would still be limits to adaptation. [Government of Saint Kitts and Nevis]
3060	SPM	25	10	25	11	SPM5: Should the top left annotation in a) read 'global mean sea level rise by 2100* ' with a footnote saying '* in all but low emissions (RCP2.6) emission scenario sea levels would be expected to continue to rise for centuries after 2100' - though maybe RCP2.6 wouldn't be exempt either; top right annotation of a): how is 'high' definition defined? Expensive? If so, how much investment as a percentage of GDP, for example? c) top box in 'effectiveness' column: 'up to several metres of SLR, with absolute limits to adaptation in many locations' and what does 'advance' mean in the third-from-bottom row heading? Suggest a more tangible word is used here. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3062	SPM	25	10	25	11	SPM5: The key messages from panel (a) about the importance of both mitigation and adaptation in reducing risks from SLR are really important, and the use of burning embers to show this is very helpful. However, the addition of the relative sea-level rise is not particularly helpful and mostly clutters the diagram, so could safely be removed with the added bonus of highlighting the key message (the risk at each emissions pathway, and the difference between adaptation and non-adaptation is the important message) even further. [Government of United Kingdom (of Great Britain and Northern Ireland)]
3064	SPM	25	10	25	11	SPM5: The concept of "time gained"through adaptation and mitigation is a useful one, however the arrows in panel (b) don't convey this very clearly - it looks as if they show that the impact is being drawn forwards in time and we'll experience it sooner? It might be better to remove the arrows entirely and focus on the key message that stringent mitigation and adaptation are needed to avoid thre worst risks from sea level rise. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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Comment id	**Chapter**	**From page**	**From line**	**To page**	**To line**	**Comment**
3402	SPM	25	10	25	11	The inclusion of two coloured bars for each key risk adds to the complexity of this Figure and is not in keeping with how these 'burning ember' figures have been used to date in IPCC reports. Adaptation is not usually included in such Figures. Recommend removing the second coloured bar for each risk and providing an alternate way to show how adaptation could reduce risk (e.g. as WGII did in the AR5). In addition, the Y-axis should be simplified as with similar Figures in the SPM. It could also be made morel clear if this figure and its caption were broken into two pieces, with panels a & b (and their caption) as one figure, and panels c & d (and their caption) as another. As it is, the figure takes two pages, with the whole caption at the end. That makes it difficult to interpret the first half (panels a & b). [Government of Canada]
3544	SPM	25	10	25	11	The figure (panels a-b) is very complicated. Please consider whether all the content is really needed for the communication of the key findings. [Government of Sweden]
4256	SPM	25	10	25	11	"This is a very important figure. Please retain. We have the following suggestions for improvement: Part a) *We suggest moving the legend for adaption to the left side to make it easier for the reader to find the information. It could also be easier to look at risk differences if the bars were sorted according to risk level, starting with urban atoll islands and ending with megacities. * The dashed lines of relative sealevel rise currently slope between the bars. At first sight this can be interpreted that the sea level will decline into the future as the left part of a) contains a time line on the x-axis. Please consider to disconnect the lines and make them horisontal across the bars instead. * In order to reduce the amount of information in this figure please consider if the ""Range of relative sea level rise across case studies"" on the bottom right is absolutely necessary information or if it could be removed from this figure. " [Government of Norway]
4258	SPM	25	10	25	11	"Part b): * Please consider using a different color for Median in rcp 8.5 as this color is similar to the color in the level of additional risk legend. * The graphic does not explain length of lines for Risk reduction gained through adaptation and total adaptation and mitigation benefit. Please consider to explain this. " [Government of Norway]
5360	SPM	25	10	25	11	SPM.5 a-b: Numbers of SLR are still from SOD, need to be updated [Government of Germany]

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5400	SPM	25	10	25	11	Figure SPM.5 a-b: As expressed in our comments to the last draft of the SPM, we strongly advise against the introduction of an adaptation dimension into the RFC-framework, and its use with reference to SLR in 2100 (instead of time-dimensionless GMST) as suggested here. While we find this draft an improvement over the last one provided, it still has many serious issues, both conceptually and in terms of content, which make the figure difficult to digest and not helpful in the context of the SPM. We generally appreciate the differentiated presentation of risk at different levels of adaptation as provided in the SPM of WGIIAR5 and AR5 SYR and would suggest that the authors look into this visual framework to convey the level of risk and risk reduction from moderate or high adaptation, instead of using the RFC framework. From our perspective, key conceptual challenges of SPM.5a+b include: (i) the lack of a temporal dimension in the RFC - the risk levels refer to absolute values, however for adaptation, the rate of change is extremely important as well; the "cut-off" at 2100 for a process such as SLR that will continue for centuries to come is arbitrary and misleading (the "original" RFC does not have a time dimension), this is particularly true also for part b of the graphic; (ii) the "high adaptation" case, that should actually be named "maximum adaptation" does not consider socioeconomic or environmental constraints, e.g. the enormous costs of such measures, and also ignores the residual risk (cf. Chapter 4 ES states: "Effective protection requires investments on the order of tens to several hundreds of billions of US$ per year globally (high confidence). While investments are generally cost efficient for densely populated and urban areas (high confidence), rural and poorer areas will be challenged to afford such investments with relative annual costs for some small island states amounting to several percent of GDP (high confidence). Even with well-designed hard protection, the risk of possibly disastrous consequences in the event of failure of defences remains (4.3.4, 4.4.2.2, 4.4.3.2, Cross-Chapter Box 9)"); ignoring the cost of adaptation/defence options and their likely equality and sustainability implications in a prominent graph assessing dimensions of risk conflicts with the general approach of the IPCC during its 6th assessment cycle to improve integration across multiple dimensions of sustainable development; while Ch4 highlights the interplay of local factors and climate change induced sea level rise for relative sea level rise and coastal risk, the figure ignores such factors (e.g. subsidence); (iii) part b) of the graphic adds another layer of complexity by asserting that risk reduction through adaptation could be equated with that through mitigation, which is conceptually flawed, as risk reduction through mitigation is permanent, while risk reduction through adaptation is time-limited in the absence of mitigation; in that sense, adaptation will not buy time but, on the contrary, lead to higher risk later in the process – unless it is accompanied by stringent mitigation; the message that a combination of stringent mitigation and high adaptation efforts could reduce risk to present day levels for megacities and urban atoll island seems at odds with other findings of the report, in particular with B9 stating that "Urban atoll islands and low-lying Arctic communities will experience high risks even in low emissions futures (medium confidence)"; (iv) the use of detected effects for moderate risk levels (in the RFC framework) seems add odds with risk reduction through adaptation, as one can not reduce risk beyond something that has been detected. In summary, we find the current representation is too complex to digest, makes disputable conceptual changes to a well-established visual (RFC) and has important scientific shortcomings. Therefore, we'd very much appreciate for the authors to choose a different visual representation of their findings as done e.g. in AR5 SYR Figure SPM.8 and underlying analysis in the WGII report, or take out part a-b of the graphic alltogether, as the main messages are also already contained in text (e.g. B9, C3) or could be added in writing. [Government of Germany]
5402	SPM	25	10	25	11	It's a source of great concern to us that although residual risks are mentioned in the text (p.26,l.18), graphic SPM.5 a and b do not reflect the fact that residual risks remain and that disasters can offset adaptation efforts. Please revise this figure in a way that reflects residual risk. [Government of Germany]
7522	SPM	25	10	25	11	For figure SPM.5 a), it would be appreciated if you could specify criteria for "Very high", "High", "Moderate" of additional risk due to sea level rise. [Government of Japan]
7524	SPM	25	10	25	11	For figure SPM.5 a), it would be better to clarify the socio-economic scenario assumed, because additional risk in megacities, urban atoll islands, and the like depend on their population changes and development. [Government of Japan]
5404	SPM	25	10	26	21	Figure a-b can be misleading - limitations of the assessments that e.g. in parts (a) and (b) show low risk for megacities under adaptation should be clearly stated (they often are in the text). For example, increasing residual risk needs to be pointed out, possibly with a similar type of bar. Also, it must be pointed out that this is average risk and does not show the local effects of single disastrous events. [Government of Germany]
7334	SPM	25	10	26	21	Figure SPM.5 is very complex. Consider simplifying or providing a series of simpler graphics to get across points for policymakers. [Government of United States of America]
7336	SPM	25	10	26	21	KEY ISSUE [STRUCTURE]: Figure SPM.5a and SPM.5b are subjective and not reproducible. Delete these panels, and have (c) and (d) serve as the graphic in totem. [Government of United States of America]

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872	SPM	25	10	26	22	Figure SPM.5 (p.25, l.10 to p.26, l.22) General comment This figure is policy-relevant. Please consider the following proposals to improve it even further. - Panel b does not add much information and is rather complex. We suggest deleting it. If the reader wants more information, the chapters should be enough. - Please consider that the table could be in a separate figure if needed. Caption The concept of 'sediment based' must be absolutely explained because it is not clear what it refers to in terms of technical arrangements and 'distributional conflicts'. Does it aims to preserve the beaches without building hard defenses and to retreat the houses since the figure evokes the 'destruction of habitat'? if so, you have to explain how. With regard to the 'Managed retreat' and its 'drawbacks', it is not certain that communities settled for only one or two decades offer strong social cohesion and cultural identity. Residents who have settled on European shores in recent housing estates or new towns are often former city people dwellers with rather individualistic rather than collective goals. (Panel c) Please consider the following suggestions: - Box « Protection – hard protection » and « Drawbacks » : Please add : "Residual risks Economic, social and technical limits" (See 4.4.2.2.4) - Box « Protection – sediment-based » and « Drawbacks » : Please add : "Beach material scarcity" (See 4.4.2.2.5) - Box « ecosystem-based adaptation » and « co-benefits » : Please add "Nature protection and biodiversity" - Box « ecosystem-based adaptation » and « Governance challenges » : It's not exactly what the report says. (44236) "More tailored financial mechanisms and policy instruments needed", "Permits difficult to obtain in some countries" - Box « advance » and « economic efficiency » : Delete this sentence. The report says that there is limited monetary information available about costs of advance. (See 4.4.2.4.3) Modify into "Limited evidence", like managed retreat - Box « accomodation » and « advantages» : Please delete "deposited sediments can raise elevation" The report doesn't focus on this point. Please add : "In situ response" (no need of human mobility nor environnemental damages) (See 4.4.2.5.5) - Box « Managed retreat » and « governance challenges » : Please modify "Unpopular topic, high reputational risk for policy makers" into "Controversial topic, ambivalent reputational risk for policy makers"(See 4.4.2.6.6) [Government of France]
8566	SPM	25	10	26	26	Figure SPM5: an important and strong figure. Panel b) is well taken and conveys important information but may not be so easily understandable (e.g. the bars indicating gains through mitigation and adaptation). [Government of Switzerland]
7338	SPM	25	11	26	21	Figure SPM.5 is confusing, and not just to policymakers. Limited evidence is represented in Chapter 4 on "no-to-moderate adaptation" and there are many caveats in Chapter 4 that do not appear in the SPM with respect to this figure. In panel (b), the horizontal line between risk reduction gained and time gained does not make sense moving to the right across the archetypal coasts. The colored arrows explain the differences in time gained. It might help to put the legend under panel (b) rather than along the left margin. [Government of United States of America]

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7340	SPM	25	11	26	21	(1) For panel (a), the figure caption describes the "no-to-moderate adaptation" scenario as "no major additional adaptation." Given that for a reader, "no-to-moderate adaptation" could encompass a wide range of possibilities, perhaps the formulation in the caption is clearer. (2) The choice to include only Arctic communities remote from isostatic rebound is intriguing. What proportion of the total communities would this represent? (3) The specificity and quantification of risk in panel (b) is striking. Is there a methodology that could be referred to? (4) In panel (c), the confidence level symbols are very helpful. What is the confidence level for cells without the symbols? (5) In panel (c), does effectiveness include financial feasibility, or only physical and technological? Readers may differ in what they assume is included. Suggest a clearer title such as "physical effectiveness" if applicable. (6) For managed retreat, improved services are listed as a co-benefit and depressed services are listed as a drawback. Is this information based on ambiguous results, regionally heterogeneous outcomes, or a mechanism in which both outcomes can occur in concert? [Government of United States of America]
8274	SPM	26	0	26	0	Figure SMP.5: The Ecosystem-based adaptation response should recognise the additional co-benefits of biodiversity restoration and/or enhancement [Government of New Zealand]
8276	SPM	26	0	26	0	Figure SMP.5: The 'managed retreat' response should recognise that there may be opportunities to apply ecosystem-based adaptation responses in conjunction - especially in low-density areas. E.g. Restoration of coastal wetlands on land from which agriculture or low density development has retreated. [Government of New Zealand]
8158	SPM	26	0			The basis for the high cost for ecosystem-based adaptation is based on Elisa Bayraktarov et al.. But most of this analysis was for developed countries. For developing countries, where the problem is more acute, the costs are two orders of magnitude lower. Check the reference [European Union]
8160	SPM	26	0			Figure SMP.5 c) – Ecosystem adaptation row mentions only wetland and coral. Other major coastal habitats, including mangroves, dune habitats, seagrass meadows. etc. are not taken into consideration. In Europe a huge effort has been and is being made to enhance the quality of these habitats for coastal protection and biodiversity conservation. Why are these not explicitly included? See also Chapter 5 executive summary, page 3, third paragraph for example. 4.3.3.5 [European Union]
8362	SPM	26	0			The IPCC needs to take care with the word "refugee" in the climate change context. "Refugee" is used in panel (c) of Figure SPM5 . People displaced by managed retreat will often remain within their country. Depending what is intended, consider ending this sentence "unclear legal status of [internationally] displaced people" [Government of New Zealand]
1144	SPM	26	0	26		Suggest clarifying why conservation and restoration of both coral and wetlands are grouped together in assessments of effectiveness, advantages, co-benefits, economic efficiency and governance challenges as there are variations between the approaches and ecosystems. Suggest coastal protection be listed as a co-benefit for coral and wetlands. Is there a reason there are only a small number of confidence levels included within the table? Are confidence levels available for all analyses? [Government of Australia]
982	SPM	26	1	26	1	SPM 5C which speaks to Response actions for building climate resilient communities in particular the section which speaks to Managed retreat should be deleted as this is not an option as the loss of sovereignty is clearly not considered. The term "Refugees" should be deleted as its use is considered contentious. [Government of Jamaica]
1518	SPM	26	1	26	1	SPM 5C Strong request to delete managed retreat as an adaptation option to responding to building climate resilient communities. Do not support using the term "Refugees" since it can create unecessary confusion. Request deleting the word refugees. [Government of Saint Kitts and Nevis]
4038	SPM	26	1	26	1	Part c): * On "Ecosystem-based adaptation" it is somewhat unclear to us what the upwards and downwards arrows mean under effectiveness. Please consider to clarify this. * The ecosystem-based adaptation part of the figure is not consistent with the last paragraph in chapter 5.5.1.2.2 where it says "Coastal ecosystems may keep pace with sufficiently gradual sea level rise, and may be more cost-effective in flood protection than hard infrastructure like seawalls (Temmerman et al., 2013; Möller, 2019).". However since c) lacks chapter reference it is difficult to judge what the conclusions in the figure on ecosystem-based adaptation rests on. [Government of Norway]
7342	SPM	26	1	26	1	In the Advantages column, Managed Retreat row: "Risks can be eliminated completely" may be true with respect to direct SLR impacts. However, risks will remain from the retreat itself, and may be substantial. This statement should have a caveat to note the limitations. [Government of United States of America]
7344	SPM	26	1	26	1	It should be noted that hard protection is high cost, especially since it says restoration is high cost. If only restoration says "high cost" it implies that other things are not very costly. [Government of United States of America]

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7346	SPM	26	1	26	1	Suggest adding "habitat" and perhaps "biodiversity" to the co-benefits of ecosystem-based adaptation. [Government of United States of America]
7348	SPM	26	1	26	1	The symbol "+++" is not used in the figure so should be struck from the key. [Government of United States of America]
7350	SPM	26	1	26	1	Coral Restoration Drawback = "High cost" is incorrect. Ferrario et al. (2013) show coral reef restoration is 1/10th the cost of comparable 'gray' infrastructure such as submerged breakwaters. [Government of United States of America]
7526	SPM	26	1	26	1	In the Figure SPM.5, threshold levels for effectiveness of EbA are described. However, we can not find statements in the underlying chapter 4 which correspond to these levels. We suggest clarifying the reference. [Government of Japan]
7528	SPM	26	1	26	1	The “+++” does not seem to appear in Figure SPM.5 c), although the caption states “+++ but limited by …”. Please check it. [Government of Japan]
5408	SPM	26	1	26	21	Figure SPM5: The figure should include reference to ecosystem-based or sustainable management of natural resources under EbA, not just conservation and restoration. [Government of Germany]
5410	SPM	26	1	26	21	SPM.5 c-d provides a helpful overview and is a valuable addition to Section C. However we have a some general concerns and suggestions for improvement, notably for panel c, which we hope the authors could consider during revision: i) Notwithstanding the changes to or deletion of SPM.5a-c, we'd encourage the authors to change the overarching title of the figure on p 25, as it currently does not seem very fitting for c-d; ii) please consider to put d) in front of c), as this would provide a more logical flow from general decision making process to individual response options; iii) please consider to somehow visually separate the row "managed retreat" from the other options, as this is the only option where people are being moved (instead of technical or ecosystem based infrastructure changes). Managed retreat constitutes a potentially very severe intrusion on the lives of those affected, including expropriation, loss of identity and social cohesion among other issues. Grouping this invasive measure together with technical adaptation into one "response options" tableau seems not appropriate, and could be misinterpreted as a recommendation by IPCC to consider all these options as exchangeable forms of adaptation. Also, while this measure may remove the risk from SLR, it obviously creates other risks and impacts for both the population concerned and the "receiving" entities/regions, so the overall effectiveness in risk reduction/resilience building depends strongly on implementation. The # specifies "displacement, migration, relocation" for managed retreat - however, displacement might be considered more of a manifestation of unmanaged retreat, and seems misplaced in this category. It may also be helpful to differentiate between cases of cross-border relocation/migration and moving to higher ground in the same area/jurisdiction, and to be more specific about what constitutes drawbacks in any case, and what are risks in the case of subpar implementation. We further propose to change the wording under governance challenges to "unclear legal status of cross border migrants" instead of "refugees", and find a more appropriate wording than "unpopular topic", which may be perceived as disrespectful. Unless managed retreat is separated in a different panel, the title of c should also be changed: removing communities from the coast would hardly be perceived as a measure of "building resilient coastal communities". In our view, this illustration does not constitute an appropriate format to address the sensitive issue of managed retreat, and we strongly urge the authors to find a more differentiated representation that separates this option from the other options and provides a more comprehensive view on the risks and challenges of specific forms of managed retreat. [Government of Germany]
5412	SPM	26	1	26	21	Add to EbA/line coral conservation /column Drawbacks/ Long term effectiveness questionable: ADD: depending on emissions scenario [Government of Germany]
5414	SPM	26	1	26	21	Suggest to add a reference about short term economic interest as a potential barrier to EbA, e.g. EbA // column governance challenges: EbA options dismissed due to short-term economic gains. [Government of Germany]
8154	SPM	26	1	26	22	include in the row of ecosystem-based adaptation under co benefits : habitat for biodiversity, increased resilience; under the column of drawbacks : delete: the long-term effectiveness is questionable what is the basis for this statement ? delete high cost rationale: if the multiple benefits are considered the conclusion is different: The difficulty being that many benefits of eocsystem-based approaches are not (eg benefits to human health) and often cannot (intrinsic value, cultural value) be costed in monetary value. [European Union]
8200	SPM	26	1	26	22	In the Ecosystem based adaptation section of figure 5, the role of mangrove is missing which should be included. [Government of India]
4426	SPM	26	2	26	2	1) "+++but limited by ocean acidification/warming" could not be found in the chart. 2) The chart should be a bit wider to facilitate reading. [Government of Monaco]
7352	SPM	26	2	26	2	"Enablers" : Is this a formal term used in the literature? For the general reader, it sounds extremely odd. This heading needs more explanation. [Government of United States of America]

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Comment id	Chapter	From page	From line	To page	To line	Comment
7354	SPM	26	2	26	21	KEY ISSUE [JARGON]: Under panel (c), Managed retreat, Governance challenges, the references to "refugees" is incorrect as "refugee" is a term of art in international law that would not apply to those displaced due to environmental factors. Moreover, there may be a variety of challenges related to relocating effected persons beyond questions related to "legal status" (which in some cases, e.g., internal displacement, may be clear in any case). Therefore, to use correct terminology and to more broadly encompass governance challenges that may be associated with displacement, suggest reframing to say: "Challenges related to the relocation of affected persons." [Government of United States of America]
7356	SPM	26	2	26	21	Under panel (c), Managed retreat, Governance challenges, what is the scientific basis for singling this out as "unpopular topic" and "high reputation risk for policymakers"? These appear to be subjective assessments that could be applied to a variety of approaches depending upon the stakeholder against whom popularity is judged. Thus, recommend deleting these. [Government of United States of America]
7358	SPM	26	2	26	21	As natural infrastructure for coastal protection is referenced earlier in the SPM, suggest adding this to the graphic. [Government of United States of America]
7360	SPM	26	3	26	15	On panel (a), this is quite confusing, even with the explanation in the caption. Take the Arctic communities. Even with present warming and sea ice retreat, several are having to plan and even start to relocate. Is relocate considered normal adaptation? If so, that needs to be said explicitly and not leave the impression that adaptation in place is possible. And are the bars and colors intended to be saying that even with all of the categories doing "high adaptation" (whatever that is), that urbanized (and say this, not "urban") atoll islands and Arctic communities are nonetheless at "very high additional risk", or is this saying it is this risk that is necessitating the "high" adaptation response. It's inadequate to be looking only out to 2100 when both scenarios continue to have rising sea level for centuries into the future. [Government of United States of America]
4608	SPM	26	4	26	4	SPM.5: the term 'archetype' does not make sense to us in this context; we suggest to remove the word. [Government of Belgium]
7530	SPM	26	10	26	12	We suggest modifying the sentence for better understanding of the phrase “no-to-moderate adaptation”. If “no-to-moderate adaptation” represents a business-as-usual scenario, as mentioned in Line 10, disaster prevention technologies are expected to be improved associated with socio-economic developments, regardless of climate change. On the other hand, “where no major additional adaptation efforts compared to today are implemented (i.e., neither further significant action nor new types of actions)” in Lines 11 – 12 could be interpreted that no significant improvement of disaster prevention technologies are assumed. [Government of Japan]
5406	SPM	26	11	26	21	This comprehensive table in SPM.5 evaluating the response options can be very valuable not only for coastal communities. The part d) should be placed a bit more separate as it may get lost in neighbourhood of the c) table. Also, please add a separate header for panel d, as for the other panels. [Government of Germany]
1146	SPM	26	14	26	14	Suggest correcting: "assumed" not "assume". [Government of Australia]
8156	SPM	26	14	26	14	a "d" is missing in the word "assumed" [European Union]
8364	SPM	26	14	26	14	Change to "full potential is assumed here" (not assume) [Government of New Zealand]
7362	SPM	26	15	26	19	Figure SPM 5 is too long and complex, especially panels (a) and (b). Recommend that panels (a) and (b) be removed, as their mixture of qualitative and quasi-quantitative display of information only fosters confusion. It would be better to explicitly state the key take-aways as written information as in panel (c). [Government of United States of America]
7364	SPM	26	15	26	19	KEY ISSUE [STRUCTURE]: To be of benefit to policymakers, it is essential that the types of adaptation being considered be explicitly stated, and the methodology for determining such explained. Panel (c) does some of this, but important aspects of what might be involved is not really stated. As drafted, the figure's implication of what can be adapted to and what cannot is not reproducible and does not have sufficient line of sight to the underlying chapters. The authors should remove panels (a) and (b) entirely, and instead focus efforts on (c) and (d) which could be strengthened by drawing additional information from the underlying report. [Government of United States of America]
4428	SPM	26	17	26	17	"horizontal" Error, replace by "vertical". [Government of Monaco]
7366	SPM	26	17	26	17	"Time gained" for what? What threshold is crossed? [Government of United States of America]
3672	SPM	26	19	26	19	Replace "Sea Level Rise" with "SLR" [Government of Brazil]
4128	SPM	26	19	26	21	The figure legend for panel c) of Figure SPM. 5 lacks chapter references. Please consider including this. [Government of Norway]
992	SPM	27	1	28	32	Increased ambitions to reduce GHG should be clearly stated as an enabling response to reducing impacts on climate change. [Government of Jamaica]
1528	SPM	27	1	28	32	It is important to note that a good example of an enabling response to reducing impacts on climate change is Increasing ambitions to reduce GHG. [Government of Saint Kitts and Nevis]
788	SPM	27	2	27	2	Please consider that a more explicit title may be given. [Government of France]

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Comment id	Chapter	From page	From line	To page	To line	Comment
4430	SPM	27	2	27	2	Need a more explicit title. [Government of Monaco]
3404	SPM	27	2	28	31	The authors might consider including an item in the SPM recommending removing incentives to maladaptation, such as government insurance for properties built close to sea level. [Government of Canada]
4054	SPM	27	4	27	10	We feel that the need for international and transboundary cooperation could be mentioned more explicit in this finding. [Government of Norway]
7368	SPM	27	4	27	10	Seems important to include "evaluating effectiveness and using adaptive management" in this list as things that are also essential. [Government of United States of America]
8620	SPM	27	4	27	10	The text in C.4 should also mention the conclusions of C4.4 that experience to date reveals that the enabling conditions of taking a long-term perspective when making short-term decisions and building governance capabilities to tackle the complexity of se sea level rise risk as well that improved coordination of SLR responses across scales, sectors and policy domains helps to address SLR impacts and risk. [Government of Netherlands]
824	SPM	27	4	27	5	It is attested in the chapter 3, P. 8 last paragraph: "Indigenous knowledge and local knowledge are different and unique sources of knowledge that are increasingly recognised to contribute to observing, understanding, and responding to climate-induced changes (Cross-Chapter Box 4 in Chapter 1)." and this should be attested in the SPM here or somewhere else. [Government of France]
4610	SPM	27	4	27	7	Sustained ocean observations are essential [Government of Belgium]
3076	SPM	27	4	28	7	C4 talks a lot about the enablers for adaptation, at the expense of mitigation. Some consideration should be given to mitigation alongside this, for example highlighting the high risks even under low emission scenarios for vulnerable systems (B9. urban atoll islands and low-lying Arctic communities). [Government of United Kingdom (of Great Britain and Northern Ireland)]
1148	SPM	27	5			Suggest deleting jargon: "actors" [Government of Australia]
1150	SPM	27	5	27	5	Suggest mentioning the need for additional support for existing mechanisms which can assist, including the Ramsar Convention on Wetlands. [Government of Australia]
790	SPM	27	6	27	6	It will be worth mentioning that capacity building and equity in partnerships are key enablers too, especally in developing countries. Add "...literacy, capacity building, equity in partnerships, monitoring..." [Government of France]
4612	SPM	27	6	27	6	Education: please change this term, where possible, to 'Capacity Development'. An equitable and sustainable development is about developing capacities, not just providing education [Government of Belgium]
4614	SPM	27	6	27	6	Climate AND Ocean Literacy / Ocean and Climate Literacy (add Ocean to the equation) [Government of Belgium]
5416	SPM	27	6	27	6	C4. Education and climate and INSERT "ocean" literacy [Government of Germany]
7370	SPM	27	6	27	6	"investment" or "finance" would be the more appropriate phrasing here. [Government of United States of America]
4074	SPM	27	6	27	9	Consider if data-sharing should be added to the examples of enablers, in addition to monitoring and forecasting, as mentioned under for example SROCC 3.5.2.1. [Government of Norway]
7372	SPM	27	8	27	8	There's a noticeable shift in language from focusing on adapation to "building resilience". Climate adaptation and climate resilience usually have different meanings and different implications for policy strategies. Is this language in reference to specific operational definitions of adaptation and resilience, or are these terms being used in a more general way? The rhetorical framing of terms such as "adaptation" and "resilence" can influence the ways in which policymakers respond to this summary. [Government of United States of America]
5418	SPM	27	12	27	12	In C4.1 regional cooperation and other governance are named; however, those are not only important to the cryosphere but essential for the oceans as well. Since regional cooperation is also highlighted in Agenda 2030 and promoted for ocean governance, it should be considered to include the "ocean" icon here, and revise the text to include Oceans. [Government of Germany]
7374	SPM	27	12	27	12	The focus only on "treaties and conventions" in referencing cooperative arrangements is overly narrow given the variety of types of mechanisms that can be used for cooperation. Recommend editing to say: "Regional cooperation, INCLUDING AS MAY BE REFLECTED IN treaties and conventions OR OTHER ARRANGEMENTS in the polar regions...." [Government of United States of America]
990	SPM	27	12	27	29	Coast legend needs to be included. [Government of Jamaica]
1526	SPM	27	12	27	29	Please include coast in the legend [Government of Saint Kitts and Nevis]
3068	SPM	27	12	28	7	A lot of the paragraphs in this section seem to say very similar things - e.g. C4.4 - C4.5 are close. [Government of United Kingdom (of Great Britain and Northern Ireland)]

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792	SPM	27	15	27	15	Perhaps write "In some Arctic and mountains regions" (rather than "In the Arctic", because in the Russian Arctic there are almost no institutional support to local and indigenous communities or municipalities (except in some very important extreme events, natural hazards). [Government of France]
7376	SPM	27	15	27	15	Wouldn't this be medium or low confidence? [Government of United States of America]
8366	SPM	27	19	27	19	Insert "due" after "losses" such that it reads: "....security and losses due to disasters...." [Government of New Zealand]
4616	SPM	27	22	27	23	Investments in education: we suggest to modify as 'Investments in capacity development at various levels.....and long-term education for context-specific...' [Government of Belgium]
5420	SPM	27	22	27	29	Section C4.2 is extremely generic and could fit in almost every type of relevant assessment. This may not be the type of key message that the SPM should communicate. Please be more specific. [Government of Germany]
8278	SPM	27	22	27	29	Useful paragraph for policy makers - please retain in SPM. [C4.2] [Government of New Zealand]
7378	SPM	27	25	27	25	Some people are climate literate or accept climate change, but don't view the issue as urgent. There is often a gap between climate knowledge and behavioral interventions people take. In promoting climate literacy, perhaps there should also be shifts in the way climate change is communicated. [Government of United States of America]
794	SPM	27	26	27	26	Please consider rephrasing because the words "knowledge-holders" "practitioners" are unclear. These two words without precisions sound as synonyms of 'stakeholders". Perhaps better to precise with an adj. who are these practitioners and knowledge-holders : indigenous and/or local communities ? enterprises ? scientists? or who? [Government of France]
3070	SPM	27	27	27	28	Is this happening? Are there any examples yet? If not (or minimal examples) suggest the text reflects this briefly too. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7380	SPM	27	27	27	28	This is a very hopeful statement representing a possibility, not nearly a certainty as is suggested here. [Government of United States of America]
4432	SPM	27	28	27	28	"transforming": Need more details [Government of Monaco]
4618	SPM	27	31	27	31	We suggest adding 'sustained ocean-observations' [Government of Belgium]
1222	SPM	27	31	27	37	This report covers two major themes: ocean and cryosphere. This paragraph lacks relevant findings on cryosphere warning. In order to ensure a balanced content, it is suggested to take and add appropriate words from the underlying report. One example is that “including early warning systems to predict extreme El Niño/La Niña and marine heat waves” is suggested to be reformulated into “including early warning systems to predict extreme El Niño/La Niña, marine heat waves, glacier instability, and snow avalanche”. [Government of China]
7382	SPM	27	32	27	33	This seems far too optimistic. [Government of United States of America]
8162	SPM	27	33	27	37	Tipping points should be added to the list of uncertainties that could be reduced by better observation. The authors already write (in chapter 6) that "confidence in a weakening AMOC over the historical is low." and (in A3.2) that there is "insufficient observational data on ice flow processes" [European Union]
8452	SPM	27	33	27	37	We salute the mention of the proposed enabler: "Sustained long-term monitoring and improved forecasts, including early warning systems to predict extreme El Niño/La Niña and marine heat waves", which is something in which Peru has been investing, but should be strengthened further. [Government of Peru]
8164	SPM	27	34			change to "including early warning systems to predict extreme El Nino / La Nina, marine heat waves and ecological variability" to reflect the potential for ecological forecasting to be used as an adaptation tool {5.5.2} [European Union]
4434	SPM	27	34	27	34	Harmonization : should be written in one word. [Government of Monaco]
7384	SPM	27	34	27	35	"help to manage" is too strong. The information has the potential to do this, but there are many societal aspects that can intervene and prevent effective management. The social science community would likely point out that much more is needed than scientific information to get effective decisions and actions. [Government of United States of America]
1562	SPM	27	34	27	36	We suggest to insert the following words " severe weather and climate extremes" just after El Nino/La Nina [Government of United Republic of Tanzania]
8368	SPM	27	35	27	35	Change to read: ".....losses in fisheries, and impacts on to human health,....." [Government of New Zealand]
3072	SPM	27	35	27	36	Suggested edit: 'impacts to human health, food security, agriculture...' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4436	SPM	27	39	27	39	I suggest combining C4.4 and C4.5 [Government of Monaco]
3772	SPM	27	39	27	50	This could be developed further e.g. beyond 2050 is clear but perspectives on how to look at 2100 or beyond would be useful as well how to address large scale change over these periods. [Government of Ireland]

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4204	SPM	27	39	27	50	Could the experiences from repsonses to sea level rise be transferred to other climate change related risks, such as wild fire, heat waves, landslides and flooding? Please consder to elaborate on this. [Government of Norway]
5422	SPM	27	39	27	50	Section C4.4 tends to be general - some specific examples might help. [Government of Germany]
6030	SPM	27	39	28	7	Contents of C 4.4 and C 4.5 overlap. Reference chapeters, figure, table of C 4.4 and 4.5 are also very similar. [Government of Republic of Korea]
7386	SPM	27	39	28	7	C4.5 seems highly repetitive with C4.4. [Government of United States of America]
7532	SPM	27	39	28	7	The contents of C4.4 and C4.5 seem redundant. We suggest deleting either of paragraphs or consolidating them. [Government of Japan]
5424	SPM	27	39	28	8	C4.4 and C4.5 seem repetitive [Government of Germany]
8280	SPM	27	40	27	42	Useful sentence for policy makers - please retain in SPM. [C4.4] [Government of New Zealand]
3074	SPM	27	42	27	44	Suggest this section also recognises that there are potentially limits to the ability of this approach to address these risks at high sea-level rise. [Government of United Kingdom (of Great Britain and Northern Ireland)]
7388	SPM	27	42	27	44	This sentence about improved coordination is really important. In California, the agencies that are more effective in implementing sea level rise adaptation and mitigation policies tend to involve the coordination of stakeholders that share a watershed. [Government of United States of America]
5426	SPM	27	47	48	5	Please merge the two statement regarding public awareness in order to shorten the text. [Government of Germany]
8168	SPM	27	52			“call for attention to time scales,” should be “call for attention to time and geographical scales”. For example sediments extraction from rivers and seafloor has an impact on the ability of sandy coastline to cope with increased storms and waves, even if extraction or alteration of sediment flux is not close to the beach.. (see for example 4.4.2.2.5) [European Union]
8166	SPM	27	52	27	53	Suggest widening the scope of this paragraph (C4.5) as the enablers mentioned can be applied to adapt/cope with changes in oceans and cryosphere. Therefore, instead of having the first sentence narrow the recommendation to sea level rise, suggest replacing "sea level rise" with "changes in ocean and cryosphere." [European Union]
4248	SPM	27	52	28	7	C4.5 seems to be repetition of C4.3 and C4.4 to a large extent. Please consider fusing the three points into two. [Government of Norway]
796	SPM	28	1	28	7	Please check that there is no redundancy with C4.4 [Government of France]
7390	SPM	28	3	28	4	What is "fair and just" climate resilience and sustainable development? Unless this term is well defined in the literature, suggest replacing it with an understandable term such as "effective climate resilience and sustainable development" or "climate resilience and sustainable development available to all relevant stakeholders". [Government of United States of America]
1386	SPM	28	9	28	11	Rephrase to: "implementation of ambitious mitigation and adaptation actions" [Government of Luxembourg]
7392	SPM	28	9	28	12	Missing reference to 6.4 and 6.8 in C5 summary box. [Government of United States of America]
8170	SPM	28	9	28	12	The message of C.5 should figure more prominently in the whole SPM, it feels like an addendum at the moment. [European Union]
8172	SPM	28	9	28	12	C5. - A summarized version of this sentence should be added here: “Hard engineering responses are more effective when supported by ecosystem-based adaptation approaches (high agreement), and both approaches are enhanced by combining with socio-institutional approaches for adaptation (high confidence). Stakeholder engagement is necessary (robust evidence, high agreement). {5.5.2} (From Chapter 5, page 10, 3d para) [European Union]
150	SPM	28	9	28	31	It is noted that this SPM does not address the differences in risks between various low emission pathways that differ with regard to the extent of overshooting. However, the time period and the amount of overshooting might make a significant difference on the risk of destabilization of ice shields and thus sea level rise. It should be clarified that only RCP2.6 pathways have been considered with no overshoot of global average temperature and/or carbon budget and that solar radiation modification (SRM) measures have not been included in any of the available assessed low emission pathways. Furthermore it might be user-friendly to clarify that a RCP2.6 scenario will result in global warming of around 2oC above pre-industrial level. [Government of Austria]
7394	SPM	28	9	28	31	Section C5 is not in line with the IPCC's mandate to present objective assessments of the scientific literature. The section should be removed from the SPM or significantly pared back. [Government of United States of America]
4620	SPM	28	9	28	9	Could it be written "Enabling climate resilience and sustainable development"? [Government of Belgium]
3078	SPM	28	10	28	10	Suggested edit: '...of a low emission pathway, combined with risk aware adaptation actions to reduce...' [Government of United Kingdom (of Great Britain and Northern Ireland)]
4086	SPM	28	10	28	10	Consider inserting "green house gas" before "pathway". [Government of Norway]
3082	SPM	28	14	28	14	The phrase 'Nations will be challenged to' is unclear, as it begs the question 'who will be challenging them?' It might be better to use the phrase 'It will be challenging for nations to...' [Government of United Kingdom (of Great Britain and Northern Ireland)]

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4622	SPM	28	14	28	14	We suggest to replace oceans-> ocean (consistence throughout the text, refer to THE Ocean /one ocean) [Government of Belgium]
7396	SPM	28	14	28	15	Provide more specifics about the types of concerted efforts that nations are currently using. [Government of United States of America]
7398	SPM	28	14	28	15	It is not clear what is meant by "Nations will be challenged to adapt to observed and projected changes in the oceans and cryosphere, even with concerted efforts to reduce greenhouse gas emissions." Do the authors mean that adapting to observed and projected changes will be challenging for nations, or merely that nations will have no choice but to adapt? Also, there is no obvious link to 6.4.1 in C5.1. [Government of United States of America]
984	SPM	28	14	28	23	C5.1 only speaks to limits under high emission scenario but it was allready stated in C1.3 that under low emission scenarios these limits may be reached therefore statement should read" Under all emission scenarios adaptation limits might be faced beyond 2100 by most ocean and cryosphere dependent communities.....etc" [Government of Jamaica]
1152	SPM	28	14	28	23	Suggest clarification or consistency. On line 17: "high carbon emissions", however, the rest of the paragraph is about GHG emissions. [Government of Australia]
1520	SPM	28	14	28	23	In an effort of being consistent , the language should state that all emissions scenarios...might be faced beying 2100.This is because C5.1 talks about to limits under high emission scenario and C1.3 talks about low emission scenarios. [Government of Saint Kitts and Nevis]
3406	SPM	28	14	28	23	In addition to highlighting the profound economic and institutional transformations needed, it is recommended to highlight the importance of context specific governance and response options that utilise all available knowledge systems including Indigenous knowledge. [Government of Canada]
3408	SPM	28	14	28	23	Section C5.1. A low emissions pathway may reduce the risks or alternatively may simply extend the time horizon at which a risk at a particular level may occur. These nuances are expressed too simply here. A further aspect of extended time horizon is, of course, a co-benefit in that it allows for extended time for adaptation and response to the risk. [Government of Canada]
7400	SPM	28	14	28	23	This is an excellent point save for lines 17-18, where the situation is quite understated. It would better framed as follows: "For scenarios with net CO2 emissions going beyond mid-century, adaptation limits are likely to be faced during the second half of the 21st century by most ocean- and cryosphere-dependent communities ..." With this rephrasing, a high emissions scenario is explained, while some communities already face such challenges, indicating that problems arise now and not just after 2100. In addition, the phrasing change will hopefully clarify that this statement applies to communities that are either ocean- or cryosphere-dependent as the present phrasing could be misinterpreted to mean that affected communities must be both dependent on the oceans and the cryosphere. [Government of United States of America]
3080	SPM	28	16	28	16	Suggested edit: '...a low emissions pathway substantially reduces the risks, in this century and beyond, from ocean and cryosphere..' [Government of United Kingdom (of Great Britain and Northern Ireland)]
3546	SPM	28	17	28	17	Suggest: "In contrast, under high emissions scenarios..." [Government of Sweden]
4116	SPM	28	17	28	17	Could it be possible to attach a confidence level to the statement "whilst also creating co-benefits", as with the first part of this sentence? Please consider. [Government of Norway]
4118	SPM	28	17	28	17	Is it "greenhouse gas emissions scenario" or "carbon emissions scenario"? [Government of Norway]
8370	SPM	28	17	28	17	Delete "carbon" before "emissions" [Government of New Zealand]
7402	SPM	28	17	28	19	The term "adaptation limits" is not used anywhere in the underlying chapter. Helpfully, Chapter 4 is much more specific about the various types of responses, their distinct limits, and the unique reasons for their limits. Section 4.4 outlines the different limits for responses to sea level rise, including protection, accommodation, and ecosystem-based adaptation, among others. The term "adaptation limits" is not a useful short-hand to represent the diversity and range of limits associated with various responses. Suggest that the authors find another way to describe these limits in the SPM. [Government of United States of America]
3548	SPM	28	19	28	19	It would be good to have a more precise idea here than "even sooner". [Government of Sweden]
8432	SPM	28	19	28	21	"Profound economic and institutional transformations, empowering vulnerable human communities, are therefore needed to achieve Climate Resilient Development Pathways in the ocean and cryosphere context (high confidence). {1.1, 1.4-1.7, Cross-Chapter Boxes 1-3 in Chapter 1, 2.3, 2.4, Box 3.2, Figure 3.4,Cross-Chapter Box 7 in Chapter 3, 3.4.3, 4.2.2, 4.2.3, 4.3.4, 4.4.2, 4.4.3, 4.4.6, 5.4.2, 5.5.2, 5.5.3, 6.4.1, 6.8.5,6.9.2, Cross-Chapter Box 9, IPCC SR1.58, IPBES 2019}" [Chapter 5.5.2] [Government of Peru]
1388	SPM	28	19	28	27	The concept of "adaption limits" needs to be put into context. It should reflect that potential limits of local adaptation measures strongly depend on the scenario considered and the context-specific risk tolerance. [Government of Luxembourg]
8372	SPM	28	20	28	20	Is it necessary to capitalise "Climate Resilient Development Pathways"? [Government of New Zealand]

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8174	SPM	28	25	25	26	Make insertion as follows: This assessment reinforces findings in IPCC SR1.5 and IPBES (2019) about the benefits of resolute and of ecosystem-based mitigation and adaptation for sustainable development and, conversely, the escalating costs and risks of delayed action to reduce climate-driven impacts and risks. [European Union]
4162	SPM	28	25	28	27	It's very positive, appropriate and timely with these references to IPCC SR1.5 and IPBES 2019. [Government of Norway]
4438	SPM	28	26	28	27	This could be stronger. In particular, I suggest that there the paragraph clearly identifies the following key messages: 1) timing is of issue, as adaptation options will not be effective in a short while from now, 2) limits to adaptation, also with compounding effects - ref. IPCC SR1.5 that could be referenced a lot more in this SPM in particular in reference to coral reefs, 3) variability across regions and the importance of local context, and 4) other stressors that should be addressed as no-regret solutions (pollution management, protection of ecosystems, etc.). [Government of Monaco]
8374	SPM	28	27	28	28	Is it necessary to capitalise "Climate Resilient Development Pathways"? [Government of New Zealand]
4184	SPM	28	29	28	30	Consider inserting "and acidification" after "impacts of climate change". [Government of Norway]
4624	SPM	28	29	28	30	We suggest to rephrase line 29 on p. 28 by ' to reduce climate change and is impacts on ocean and cryosphere systems'. [Government of Belgium]
7404	SPM	28	30	28	30	Urge adding an additional phrase to the end of the sentence: "... as well as pursuing ambitious mitigation of both short- and long-lived species." Without also saying -- and accomplishing --this, adaptation and resilience building simply won't be enough. [Government of United States of America]
1154	SPM	28	45	28	49	Suggest the legend include the icons for coasts and oceans. Para C2.1 refers to protected areas, on land and at sea - and coastal habitats – but would benefit from other icons too. [Government of Australia]