

SROCC Second Order Draft Government and Expert Review Comments - Chapter 6							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
10857	6	0	0	0		This chapter assesses extremes and abrupt or irreversible changes. Then a separate sub-chapter on the irreversibility of mass loss from the Greenland and Antarctic Ice Sheets should also be included (see also my comment 1) [Ola Kalén, Sweden]	Noted. It was felt that ice sheets were better discussed in the polar and SLR chapters, as that is where the expertise lies.
12105	6	0	0	0		This chapter is structurally unbalanced, with the ocean taking too high a proportion. So it is suggested to add cryosphere-related extreme events, such as ice avalanche and glacial lake outburst flood (GLOF), so that their effects and damages can be fully considered. [Government of China, China]	Noted. The structure arose during the scoping, approval and subsequent LAM discussions. Cryosphere-related extremes are discussed in other chapters
12893	6	0	0	0		Cascading risk should be a focus of this chapter and, consequently, feature prominently in the summary products. We find the current discussion of this important effect not very conclusive, but would appreciate to see a more substantive discussion with robust conclusions (or a clear statement about the reasons for a lack thereof) incorporated into the SPM. Currently, cascading risks receive only cursory mentioning in the SPM, which is unfortunate given the high risk potential it carries. Please also make sure that relevant information from other chapters (e.g. Mountain regions) is adequately summarized in Chapter 6. [Government of Germany, Germany]	Accepted - we have now adjusted the executive summary
15131	6	0	0	0		Chapter 6 introduces two new terms, cascading impacts and compound risk. We find both the definition provided on p 7 In 36-42 and the visual representation in Figure 6.1 plus caption to be incomplete, not concise and partly inconsistent. E.g. a compound risk could arise from the superposition of a long-term trend and one or several extreme events, it is not necessarily limited to a combination of extreme events. The term cascading impact seems to narrow, as it is focused solely on human systems and ignores cascading impacts for unmanaged systems, e.g. through a long-term drought exacerbated by a heatwave and fire. If this definition is deliberately chosen to limit the scope to human systems, it should be made clear and explained. In addition, the terms compound/cascading impact/risk are used interchangeable throughout the chapter, indicating a lack of maturity of or agreement about the concept. Please ensure that terminology is used consistently throughout the chapter, the report and in particular in line with the Glossary definitions. Please revise Figure 6.1 and the definitions provided in 6.1. [Government of Germany, Germany]	Accepted - these definitions have now been revised and used consistently
15877	6	0	0	0		Examples of cascading regime shifts and impacts do not appear to have been sufficiently covered in this chapter. In other words, what would happen to ENSO and other modes of interannual climate variability if abrupt changes take place in ocean circulation and vice-versa? (e.g., "Cascading regime shifts within and across scales", Juan C. Rocha, Garry Peterson, Örjan Bodin, Simon Levin, Science 21 Dec 2018: Vol. 362, Issue 6421, pp. 1379-1383) - DOI: 10.1126/science.aat7850 ) [EUCF, Belgium]	We have chosen to illustrate these concepts using the 3 case studies
16429	6	0	0	0		Thanks a lot to the authors for their hard work! Section 6.2, in particular, will prove to be very helpful. We noted a few general issues that we thought are important to mention in the beginning. The individual ES paragraphs are too long and stand in the way of clearly communicating the key findings of the chapter assessment. As part of the risk management assessment, the issue of limits to adaptation has to be covered in more detail. This aspect is of growing importance as it feeds into the loss & damage discourse that is emerging as a key aspect of the UNFCCC negotiations (covered under 6.9.1). [Alexander Nauels, Germany]	Accepted - the ES has been re-written. L&D and limits to adaptation are further discussed in 6.9.1

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22567	6	0	0	0		<p>Suggest the concepts of compound events, sequential/cascading events and multiple simultaneous events be introduced and better intergrated and used consistently throughout the Chapter.</p> <p>For example, the examples provided on page 47 lines 39-48 are useful, however, they need to be explained better and up front in section 6.8.1. [Government of Australia, Australia]</p>	Accepted - definitions have been revised and are ow used consistently
22569	6	0	0	0		<p>Suggest revising the Section subtitles. They are currently ambiguous. E.g. 6.8.2 is Cascading impacts or cumulative effects on ecosystems. Does this section deal with one OR the other? The next section is titled Cascading Impacts and Cumulative Risks on Social Systems,whereby cumulative risks are not defined. The title of 6.8.4 is similarly not very clear. [Government of Australia, Australia]</p>	The heading has been changed to Cascading Impacts on Ecosystems
23379	6	0	0	0		<p>I congratulate the authors for the second order draft. I have provided comments to the SPM that are relevant for executive summaries of all chapters.The use of the IPCC calibrated language is still missing in the expression of key findings at the end of sections (in summary, ...). The conclusions (ES) do not enough highlight what is new since AR5, and this is also missing in several sections . Some aspects overlap with what will be assessed in AR6 WGI and need to be considered very carefully (esp. the confidence level) (cyclones, abrupt change). At the moment an assessment of confidence is still missing for the summary statements in some sections or subsections, this needs a quality control by CLAs so that the IPCC quality standards are met. [Valerie Masson-Delmotte, France]</p>	Accpeted - hopefully these issues are now resolved
23729	6	0	0	0		<p>This chapter assesses extremes and abrupt or irreversible changes. The irreversibility of mass loss from the Greenland and Antarctic Ice Sheets could also be mentioned. [Government of Sweden, Sweden]</p>	Noted. It was felt that ice sheets were better discussed in the polar and SLR chapters, as that is where the expertise lies.
31411	6	0	0	0		<p>Many sections have little or no use of calibrated uncertainty language, please ensure this is used for key findings [Hans-Otto Poertner and WGII TSU, Germany]</p>	Accepted - now resolved
5195	6	0	0	0		<p>ES is light on figures re: impacts, responses and related costs [Debra Roberts and Durban Team, South Africa]</p>	Noted. We did not feel that such figures could be reliably extracted from the lierature
5265	6	0	0	0		<p>Figure 6.1 - Don't have references [CRISTOBAL FELIX DIAZ MOREJON, Cuba]</p>	Noted. Figure 6.1 now modified.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11187	6	0	0	0		<p>About the section 6.3.5 Risk Management and Adaptation:</p> <ul style="list-style-type: none"> <li>• It is suggested to improve the Paragraph "6.3.5. Risk Management and Adaptation ", it would be more effective to recall a list and a description of some approaches to risk management and adaptation for Tropical and Extratropical Cyclones and Associated Sea Surface Dynamics, i.e. provide some methodological tools in order to better manage these events. In this context, an integrated approach aimed at suggesting a first reference framework for the governative agencies should be built on the basis of best practices, which will then be called to operate in local contexts (but whose actions have transnational relevance), instrumental choices to implement actions aimed at risk management and especially adaptation, which should stem from a proactive policy resulting from local choices, but that are part of choices taken at the global level, of which the Intergovernmental Panel on Climate Change (IPCC) he can act as guarantor. Would it be significant to introduce a reflection on the issue of proactive and reactive policies, ie is it better retreat or rebuild after storms or better to take preventive planning actions resulting from specific proactive policies aimed at reducing social, economic, ecological, cultural coastal vulnerability? At this point it would be interesting to compare the economic evaluation of retreat or rebuild actions with those of prevention in the medium and long term. This analysis could help to verify the economic sustainability at local level of preventive actions, and could offer guidelines to establish some addresses aimed at inaugurating a new season of thought since everything is glocal, in which stronger economically countries could participate in the costs of prevention of weaker economically countries, given that these issues operate on a system, of which the various communities are subsystems that interact even if physically distant.</li> <li>• It is not significant to note the lack of coordination between the different government agencies, as shown on page 6-21 in line 17, but it would be important to suggest in this document, a path of governance starting from the Intergovernmental Panel on Climate Change (IPCC) ) of all government agencies, in order to identify a supranational management network to undertake an effective, organized and systematic risk management and adaptation path for Tropical and Extratropical Cyclones and Associated Sea Surface Dynamics that has a local dimension but especially global. It is necessary to create an effective network for the protection of the coasts aimed at creating knowledge, awareness, best practices of policies and actions aimed at promoting cooperation between countries, communities to address global issues. [Maria Rosa Trovato, Italy]</li> </ul>	Accepted. These points have been taken into account in the revised text.

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11189	6	0	0	0		<p>About the section 6.4.3. Risk Management and Adaptation, Monitoring and Early Warning Systems and the section 6.5.3 Risk Management and Adaptation for the Extreme ENSO Events and Other Modes of Interannual Climate Variability</p> <p>It is suggested to improve Section 6.4.3. "Risk Management and Adaptation, Monitoring and Early Warning Systems", 6.5.3. Extreme ENSO Events and Other Modes of Interannual Climate Variability</p> <ul style="list-style-type: none"> <li>• Also in this case it would be effective to recall a list and a description of some approaches to risk management and adaptation for Marine Heatwaves and Extreme ENSO Events and Other Modes of Interannual Climate Variability i.e. provide some methodological tools in order to better manage these events for the reasons previously mentioned.</li> <li>• Also in this case it is important to promote the coordination between the different government agencies, and therefore to suggest a possible model of governance.</li> <li>• Again, this point would be interesting to compare the economic assessment of damage, mitigation actions with those of prevention in the medium and long term. [Maria Rosa Trovato, Italy]</li> </ul>	Accepted. These points have been taken into account in the revised text.
11191	6	0	0	0		<p>About the section 6.6 Inter-Ocean Exchanges and Global Change</p> <p>The authors do not address the question of risk management and adaptation in relation to Inter-Ocean Exchanges and Global Change, even in this case they could identify actions and develop the points previously mentioned for them. [Maria Rosa Trovato, Italy]</p>	Noted. There was not sufficient literature on which to base such a section.
11193	6	0	0	0		<p>About the section 6.7.3. Risk Management and Adaptation for Risks of Abrupt Change in Ocean Circulation and Potential Consequences and the section 6.8.4 Risk Management and Adaptation, Sustainable and Resilient Pathways</p> <p>It is suggested to improve Section 6.7.3. Also in this case it would be effective to recall a list and a description of some approaches to risk management and adaptation for Marine Heatwaves and their Implications, "Risks of Abrupt Change in Ocean Circulation and Potential Consequences", ie provide some methodological tools in order to better manage these events for the reasons previously mentioned.</p> <ul style="list-style-type: none"> <li>• Also in this case it is important to promote the coordination between the different government agencies, and therefore to suggest a possible model of governance.</li> <li>• Again, this point would be interesting to compare the economic assessment of damage, mitigation actions with those of prevention in the medium and long term. [Maria Rosa Trovato, Italy]</li> </ul>	Accepted. These points have been taken into account in the revised text.

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11195	6	0	0	0		<p>About the section 6.9 Governance and Policy Options, Risk Management, Including Disaster Risk Reduction and Enhancing Resilience</p> <p>It is suggested to deepen this paragraph further, on the basis of the elements highlighted in the previous points that can offer a better described and analysed point of view that can give a more efficient answer to the question addressed by this document.</p> <p>The decision-making process on the basis of the highlighted elements is better framed because it is supported by a governance model on the various issues and the climate issue in general, in which it is possible to identify a set of decision makers or decision facilitators, i.e. the government agencies that have the task to promote knowledge, awareness of issues at local level with policy-makers and communities in order to identify specific policies aimed at implementing a global risk reduction project and identifying the economic resources to be allocated to them, including in the framework of Cooperation between countries can be aimed at responding to the age-old question of intra-generational equity. [Maria Rosa Trovato, Italy]</p>	Accepted. These points have been taken into account in the revised text.
16547	6	0	0	0		<p>Should add the summaries of Section 6.6 to section 6.8 in the Executive Summary [Hoang Anh Le, Vietnam]</p>	Accepted. The ES has now been re-written.
23297	6	0	0	0		<p>I congratulate the authors for the second order draft. I have provided comments to the SPM that are relevant for executive summaries of all chapters. The use of the IPCC calibrated language is still missing in the expression of key findings at the end of sections (in summary, ...). The conclusions (ES) do not enough highlight what is new since AR5, and this is also missing in several sections. Some aspects overlap with what will be assessed in AR6 WGI and need to be considered very carefully (esp. the confidence level) (cyclones, abrupt change). At the moment an assessment of confidence is still missing for the summary statements in some sections or subsections, this needs a quality control by CLAs so that the IPCC quality standards are met. [Valerie Masson-Delmotte, France]</p>	Accepted - hopefully these issues are now resolved
27277	6	0	0	0		<p>No comments [Gleyci Moser, Brazil]</p>	Noted
27279	6	0	0	0		<p>General comments- include some regional policies on control and mitigation. [Gleyci Moser, Brazil]</p>	Noted. Mitigation is not a major focus of the SROCCC
31533	6	0	0	0		<p>The chapter executive summary gives a nice overview with some indication of magnitude for climate system change, but mostly qualitative statements on impacts. The imbalance between such treatments should be amended to the extent possible. It would be more punchy if key findings could be detailed (specified and quantified), also and especially with respect to solution options by adaptation and mitigation efforts. [Hans-Otto Poertner and WGII TSU, Germany]</p>	Accepted - we have tried to do this where the literature is available
34091	6	0	0	0		<p>Future changes in frequency of extreme El Nino or La Nina events is emphasized in Section 6.5 because of high climatic impacts associated with such events. However, a multi-year persistence of even a moderate event could cause droughts, or bring floods over certain regions, and therefore should also be considered in this context. (Okumura et al. 2017: Evolving impacts of multiyear La Nina events on atmospheric circulation and US drought) [Government of United States of America, United States of America]</p>	Noted. These issues are discussed in section 6.5 but there was not enough literature to justify an ES statement
34093	6	0	0	0		<p>Studying interactions between ENSO, and other modes of variability could improve confidence in ENSO modulated extremes, e.g., Patricola et al. 2014 (The Impact of the El Nino-Southern Oscillation and Atlantic Meridional Mode on Seasonal Atlantic Tropical Cyclone Activity) [Government of United States of America, United States of America]</p>	Noted

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34095	6	0	0	0		A relevant reference on abrupt loss of sea-ice in high latitudes. (Holland et al. 2006 ; Future abrupt reductions in the summer Arctic sea ice) [Government of United States of America, United States of America]	Noted. We have generally assessed the most recent literature since AR5
34097	6	0	0	0		A better understanding of inter-basin interactions are needed to improve confidence in future ENSO changes. A recent study by Hu and Fedorov, 2018 (Cross-equatorial winds control El Nino diversity and change) highlights the role of tropical north Atlantic in modulating ENSO strength in recent times. [Government of United States of America, United States of America]	Accepted. Now cited.
2615	6	1	0	80		This chapter is very nicely written. Only the Fig. 6.8 on page no. 39 is looks a bit blurred (specially the yellow lines) in current version of the report, therefore it needs to be replaced. [Pushp Raj Tiwari, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Figure now revised
2957	6	1	1	2	14	The extreme climate events in Asia and China induced by ocean change are less reported from the past to the future [Xingrong Chen, China]	Noted. We have based the assessment on the available scientific literature
2589	6	1	1	80	1	The rest of the chapter, at least the parts for which I have expertise, reads very well. [Eric Guilyardi, France]	Noted
14589	6	1	1	80	60	The scope of this chapter needs to be clarified, and made more consistent, to help the reader. The scope quoted on page 6-3, lines 3-5 is very broad. However, many relevant systems (e.g. ice sheets, permafrost) are only mentioned in passing in Table 1: they are not analysed and are absent from the Executive Summary and 'Summary and Knowledge Gaps'. This could be addressed by expanding the Executive Summary and section 6.10 to include everything in Table 1 (with references to the relevant detailed sections in other chapters). Another options is condensing Table 1 and the quoted scope to only include what is actually analysed in the chapter. In any case, please make sure that the scope at the start of the Executive Summary matches the actual scope covered in the chapter. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Now clarified at the start of the ES.
15881	6	2	34	2	34	Colour scale not colour blind reader friendly. [EUCE, Belgium]	Accepted. Now re-drawn.
31515	6	3	1	0		Please refer to WGII AR5 for examples of Executive Summary statements, start each with one highlevel sentence in bold conveying the policy-relevant message [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. The ES has now been re-written.
26077	6	3	1	53	36	Acronyms should be avoided as much as possible and in particular in the executive summary, but also elsewhere. IPCC reports are often not read from start to end and it makes the report/chapter less readable if one has to flip back and forth. The chapter should be readable for readers who are not in the field and familiar with WBC, ETC, SLR, TC, PCR and many more. In many instances one can simply rephrase or use a shorter spelled out version when the context is clear. P19, Lines 33-43 is an example where it becomes hard to follow ith about 10 different acronyms in just a few sentenes. [Regine Hock, United States of America]	Accepted. We have tried to minimise their use.
23969	6	3	1	54	41	Once an abbreviation has been introduced, suggest it used throughout the document. (e.g. Sea Surface Temperature (SST), General Circulation Model (GCM)) [Government of Japan, Japan]	Noted. We feel it is sometimes useful to redefine acroynms as the reader may not read the whole chapter from start to finish.

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9851	6	3	7	3	10	Sea level does not impact cyclones but it is a co-factor in impacting coastal societies during tropical and extratropical cyclones (and storms). [Government of France, France]	Accepted and re-phrased
31517	6	3	7	3	13	is the new finding that climate change has increased the severity of tropical cyclones? [Hans-Otto Poertner and WGII TSU, Germany]	Yes, based on event attribution
12895	6	3	7	3	20	Please clarify to which warming scenarios these statements refer. In particular, please check if in In 11, "slightly" is also valid for RCP8.5 conditions. [Government of Germany, Germany]	Rejected - These statements refer to observations
23277	6	3	7	3	20	Consider very carefully the first sentence : is the level of confidence on attribution methods for single storms high? Which fraction of storms have been explored by attribution studies? Be more explicit about "a number". Remove "is required to" (seems prescriptive). [Valerie Masson-Delmotte, France]	Accepted and re-phrased. Selection bias is discussed in the main text in 6.2.2
31519	6	3	7	3	20	Could this paragraph be split into two - one that addresses current and future changes and one that describes possible responses (or their current limitations)? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
23393	6	3	7	9	1	The chapter obtains many important conclusions. However, these conclusions, e.g., presented in Page 3, Line10-15, 22-29, Line37-45, P45, Line43-44, and Table 6.1, would be better to be expressed by following the rules of "Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties" such as 9), 10), 11): E) and F) etc.; Or they should follow the "SROCC LAM3 Treatment of uncertainty Guidance for IPCC authors" presentation that was presented by vice chair of IPCC during LAM3 in Lanzhou, e.g., when necessary and where possible quantify uncertainty with a likelihood assessment (requires sufficient confidence). Please pay attention on the "requires sufficient confidence". [Rongshuo Cai, China]	Accepted. The ES has now been re-written
8151	6	3	8	0		Place hyphen after "tropical" to indicate that the cyclones should follow "tropical" as well [Nina Hunter, South Africa]	Accepted
4581	6	3	8	3	8	What impacted? Intensity? Duration? Specify [The UBern Team Group Review, Switzerland]	Accepted and re-phrased
5261	6	3	8	3	8	I proposed change the verb impacted by influenced because better reflect how elevated sea surface temperatures and sea level act over tropical and extratropical cyclones [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted and re-phrased
22225	6	3	8	3	9	"...have impacted a number of..." wording may be misinterpreted as a statement on the frequency of TCs [Abram Nerilie, Australia]	Accepted and re-phrased
11147	6	3	9	0		You should enter the meaning of the following acronyms: TCs and ETCs, proposed by the authors on page 6-3 at line 9; [Maria Rosa Trovato, Italy]	Accepted. Acronyms removed from ES
2459	6	3	10	3	11	I begin to see a pattern in this IPCC Special report. Authors tend to report worrying trends but skip silently over encouraging facts. In this case only the higher intensity of tropical cyclones is reported and the expected reduction in frequency is kept quite about. Please take this reporting serious and report the whole picture, not just what may fit into your personal view. The subject is much too serious to distort the picture. There are no long-term trends in tropical and extra-tropical storms to back this up. Rather, ocean cycles like the AMO influence the storm frequency. See e.g. Weinkle et al. 2012 (doi: 10.1175/JCLI-D-11-00719.1) [Sebastian Luening, Portugal]	Rejected. There we assess low confidence in future frequency changes (as stated)

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14591	6	3	10	3	11	The sentence: "In the future, tropical cyclones will likely be of slightly higher intensity..." seems to contradict the evidence I have seen in a number of published papers and reports, which would point towards substantial increases in intensity of future tropical cyclones... [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted and re-phrased
23685	6	3	10	3	11	It is not entirely clear what "tropical cyclones will likely be of slightly higher intensity". Does this refer to the strongest storms, or a shift in the statistical distribution of storms? [Government of Sweden, Sweden]	Accepted and re-phrased
29747	6	3	10	3	11	This needs to say, "will, on average, likely be" as this finding relates to averages. Out in the world, people typically only experience one or a few tropical cyclones, and so averages don't really apply. [Michael MacCracken, United States of America]	Accepted and re-phrased
15841	6	3	11	3	11	Better to specify at least a numerical range of what this "slightly higher intensity globally" means. For many SIDS and EU Outermost Regions tropical cyclones evolution is crucial, so we should bring to the executive summary more detail. [EUCE, Belgium]	Accepted and re-phrased
15879	6	3	11	3	11	Coral bleaching in the Caribbean and Eastern Pacific do not appear in table or map? Why only highlight the Great Barrier? [EUCE, Belgium]	This is discussed extensively in Chapter 5
14593	6	3	11	3	12	The sentence: "While some resilience plans exist to prepare for these storms, more effort is required to further develop and implement such plans" is not very clear, potentially ambiguous and also factually incorrect, because resilience plans vary greatly between countries and even areas/regions within the same countries, with some places having in places very robust plans that get reviewed regularly and other places having very little if any plans at all... [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted and re-phrased
14595	6	3	12	3	13	The following sentence: "Warning systems exist and can be adapted and improved to manage the risks associated with extreme El Niño and La Niña events" is slightly misleading and should be rephrased. Warning systems can help us prepare for and manage the impacts of rather than the risks associated with El Niño and La Niña events. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted and re-phrased
23687	6	3	12	3	13	"more effort is required to further develop and implement such plans" does not say very much. Perhaps "Current resilience plans that exist to prepare for such storms are not sufficient in the face of climate change.", or suchlike. [Government of Sweden, Sweden]	Accepted and re-phrased
8153	6	3	13	0		Suggest remove "&" and insert "and" for consistency with remainder of the text [Nina Hunter, South Africa]	Accepted
3667	6	3	13	3	13	Category 4&5 --> Category 4 & 5 [Nam SungHyun, Republic of Korea]	Accepted
5105	6	3	13	3	13	What is the magnitude of the increase? [Debra Roberts and Durban Team, South Africa]	It is difficult to give a range here.
4583	6	3	14	3	14	delete 'global scale' [The UBern Team Group Review, Switzerland]	Accepted



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23689	6	3	14	3	14	Could consider changing "although" to a full stop, and then starting a new sentence. This would add clarity. [Government of Sweden, Sweden]	Accepted and re-phrased
10227	6	3	15	3	15	Rising sea level will contribute to "higher risk of storm surge" instead of "higher storm surge". It should be noted that "storm surge" normally refers to the increase in water level relative to the normal astronomical tide level due to tropical cyclones. [SAI MING LEE, China]	Accepted and re-phrased
12897	6	3	15	3	15	This is a very important finding, and even one with high confidence. Please move this line upwards to the bold section of the para. Please add the sentence from page 6-20, line 55: Storm surge has become the world's most deadly and destructive natural hazard {6.3}. Please provide a confidence assessment and lift this crucially important information to the SPM. [Government of Germany, Germany]	Accepted
12899	6	3	15	3	15	Please provide additional information on the importance of storm surges. [Government of Germany, Germany]	More details can be found in section 6.3
29749	6	3	16	3	20	Might it also be appropriate to say something for ships and boats, etc. at sea? The storms tend to be at their more powerful stage at sea, tend to be lasting longer so more time at sea, being able to intensify rapidly at sea, and will push out larger and larger waves to long distances. So might it be appropriate to be advising the international shipping community that their ships could well have more exposure to very rough conditions, need to be very wary of venturing into areas where tropical cyclones could intensify rapidly, etc. And might it be appropriate to be offering advice to offshore facilities, everything from oil and gas platforms to windmills, etc.? And what about advice for island nations that might become subject to worsening general conditions even if the storms do not come their way. It seems to me more needs to be said (and I look forward to reading the rest of the findings to see if this is the case). [Michael MacCracken, United States of America]	We did not find any suitable literature on this topic
5263	6	3	18	3	18	I suggest add: .....Coordination problems among disaster response organizations, the insufficient quantity of early warning systems joint to no systematic monitoring, and the lack of adequate local plans of preparation and resilience for TCs and ETCs also persist [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted. Statement now re-phrased
14599	6	3	19	3	19	Suggested change to text - "and cannot continue to mitigate all future impacts' is better [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Statement now re-phrased
10087	6	3	22	3	22	The sentence could begin with "Prolonged anomalous warm water events (Marine Heatwaves, MHW) have very likely doubled in frequency..." [Elsa Arellano-Torres, Mexico]	Accepted. Statement now re-phrased
12901	6	3	22	3	22	Please check if "virtually certain" applies instead of "very likely". [Government of Germany, Germany]	We have assessed the likelihood at the very likely level

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29751	6	3	22	3	25	I think it would be helpful in the importance of MHWs was made clearer right in the first sentence of the finding, so getting the text on lines 27-29 more in the lead to this finding. Otherwise, I'm not sure that, when extracted as a key finding, it will be clear why to be worried about these events. I'd also note that saying they are most important in the Arctic must mean that it is the departure from the norm that is the key, not mainly the absolute temperature--and this is a point worth making as well. [Michael MacCracken, United States of America]	Accepted. Statement now re-phrased
636	6	3	22	3	35	It could help to provide a clearer historical picture. [Jenna Pearson, United States of America]	This is difficult due to the lack of historical daily SST data
23279	6	3	22	3	35	to be more highlighted in SPM [Valerie Masson-Delmotte, France]	Noted
23395	6	3	22	3	35	In page 3, line 38-39, the authors pointed out that "Warning systems exist and can be adapted and improved to manage the risks associated with extreme El Niño and La Niña events." This is a good point. Similarly, it seems that the authors can also consider and propose the warning systems for Marine heatwaves (MHWs), which exist and can also be adapted and improved to manage the risks associated with extreme MHWs events. Particularly, the authors have pointed out that MHWs have very likely doubled in frequency since the early 1980s with one quarter of the worlds' oceans experiencing either the longest or most intense events on record in 2015 and 2016. Therefore, the warning system would be very helpful for reducing the impacts of Marine Heat Wave and the related disaster or risk. [Rongshuo Cai, China]	Accepted. Statement now added
31531	6	3	29	0	31	While the quantification of change is captured to some extent for the physical systems the impacts on living systems also need to be captured more fully as well as their degree of change. [Hans-Otto Poertner and WGII TSU, Germany]	Acccpeted - we have tried to do this where the literature is available
23691	6	3	31	3	31	How extreme is a one-in-hundred day event? Something that is expected three times a year would seem something that should be fairly expected [Government of Sweden, Sweden]	We now use frequency as a measure rather than return period
22241	6	3	31	3	32	This quantified statement on MHWs could be incorporated into SPM figure 1 [Abram Nerilie, Australia]	Noted
31521	6	3	34	3	35	Readers of the Executive Summary might appreciate more details about how the vulnerability can be reduced. Is there any information in the chapter that could be added to the Executive Summary (perhaps as a second paragraph about MHWs)? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - see section C statements
14601	6	3	35	3	35	Suggested change to text - 'and tourism, but are as yet unproven at scale" [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted
29753	6	3	37	3	38	I think it would be useful to give an indication of why such events are important right in the first sentence, saying something like that such events cause significant and seasonally persistent shifts in the regional patterns and intensities of rainfall and drought, with the capability of causing significant ecological and societal disruption. [Michael MacCracken, United States of America]	Rejected. We feel that the impacts of ENSO are widely discussed elsewhere (and in section 6.5). This is meant to be a summary.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 6							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
12903	6	3	37	3	44	There seems to be a contradiction: "Extreme El Niño and La Niña events are likely to occur more frequently in the future, even at relatively low levels of future global warming (medium confidence)" versus "It is currently unknown if there has been an anthropogenic influence on observed El Niño Southern Oscillation (ENSO) events and impacts" [Government of Germany, Germany]	There is no contradiction. No attribution study exists
10229	6	3	37	3	45	It is not recommended to include this paragraph in the Executive Summary since the studies involved adopted a definition of El Nino (based on precipitation) which does not reconcile with the definitions adopted by major climate centres. It should be noted that the definition of El Nino is normally based on the SST anomalies of the Nino regions or the Southern Oscillation Index. Examples: <a href="http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php">http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php</a> <a href="http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/elmonout.html#table">http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/elmonout.html#table</a> <a href="http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml">http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml</a> <a href="https://iri.columbia.edu/our-expertise/climate/forecasts/ens0/current/?enso_tab=enso-iri_update">https://iri.columbia.edu/our-expertise/climate/forecasts/ens0/current/?enso_tab=enso-iri_update</a> [SAI MING LEE, China]	Rejected. This is based on a number of published studies which do look at both precip and SST indices
22231	6	3	37	3	45	This paragraph would benefit from saying why Extreme El nino and La Nina events are expected to be more frequent in the future. At the moment the paragraph text seems to not support the bold statement at the start of the paragraph. [Abram Nerilie, Australia]	Rejected. The reasons are quite complex and are different for El Nino and La Nina so there is not enough room to discuss why. More details are give in the main text.
22537	6	3	37	3	45	Suggest clarifying the apparent conflicting statements on the likelihood of future extreme El Nino and La Nina: "are likely to occur more frequently in the future global warming", and "it is currently unknown if there has been an anthropogenic influence on observed ENSO events and impacts". [Government of Australia, Australia]	Accepted. Now clarified.
31523	6	3	37	3	45	Can anything be said about consequences of El Niño and La Niña events for society and economy or even about how impacts could be addressed or risks be managed exactly, apart from early warning? [Hans-Otto Poertner and WGII TSU, Germany]	There is virtually no literature for future ENSO. Plenty for presnt day ENSO but we didn't want to write a textbook.
32633	6	3	37	3	45	There is emerging literature (Cai et al., 2019), Grothe et al., in review, that suggest, on top of previously assessed literature, that there has been a shift in ENSO properties related to anthropogenic climate change. I feel the conclusion stated here does not reflect this evolution in data and model evaluation. Note that this is one place, given model biases, wehre we might expect to see detection in paleodatasets before a formal D&A is possible. This might be noted as well - ie model limiations are the main stumbling block right now, but data are really suggesting something different is happening with ENSO over last decades. [Kim Cobb, United States of America]	Accepted. Hopefully this is capture in the main text and ES statement
25825	6	3	37	3	46	I believe is better to mention that El ENSO ia global phenomenal and their impacts is a locally scale, will be interesting to mention which and where have the warning systems. For another hand, the characteristic of precipitation in the cost of pacific, doesn't depend necessarily of the El Niño here the referencie ( <a href="https://web2.senamhi.gob.pe/rpga/pdf/2009_vol01/art5.pdf">https://web2.senamhi.gob.pe/rpga/pdf/2009_vol01/art5.pdf</a> ) [ELIZABETH SILVESTRE, Peru]	Rejected. This paper is about present day ENSO, not about the impacts of climate change

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14597	6	3	38	3	39	The following sentence: "The equatorial Pacific trade wind system has experienced extreme variability in the last two decades, influencing global-scale climate and contributing to the 'global warming hiatus'" should be followed by a brief explanation of how changes and/or the increased variability in equatorial Pacific trade winds have contributed to the global warming hiatus. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	We are advised that this topic will be covered in detail in AR6. There was not enough space here for the detailed treatment needed
4585	6	3	39	3	39	Replace 'manage' with 'reduce' [The UBern Team Group Review, Switzerland]	rejected. We prefer managing the risks (see title of chapter)
22227	6	3	40	3	43	Might need to define what "modern observational period" means here. I was surprised to not see 1974 listed as an extreme La Nina, but maybe this is because this is outside of the satellite SST observation period? [Abram Nerilie, Australia]	Accepted. Now clarified.
22229	6	3	40	3	43	I'm also surprised to not see 2010-11 listed as an extreme La Nina [Abram Nerilie, Australia]	Definition is based on Cai et al. 2015, which is cited
8149	6	3	42	0		No definition provided for La Nina [Nina Hunter, South Africa]	Definition is based on Cai et al. 2015, which is cited
10231	6	3	42	3	43	The text was not found in the chapter. [SAI MING LEE, China]	Definition is based on Cai et al. 2015, which is cited
10233	6	3	42	3	43	There were stronger La Nina events in the 1950's and 1970's. Ref.: <a href="http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php">http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php</a> [SAI MING LEE, China]	Definition is based on Cai et al. 2015, which is cited
2707	6	3	43	3	44	Kim et al. (2014) showed that El Niño sea surface temperature variability has responded to greenhouse warming. As demonstrated by the standard deviation of the Niño3.4 index over 20-, 30- 40-, or 50-year running periods starting in 1950, available observations consistently show that the amplitude of ENSO SST variability has enhanced over the past several decades. Kim et al., 2014, Response of El Niño sea surface temperature variability to greenhouse warming, Nature Climate Change, DOI: 10.1038/NCLIMATE2326 [Thian Yew Gan, Canada]	Accepted. Now cited.
4587	6	3	43	3	44	Why not simply say: on observed El Niño and La Nina events [The UBern Team Group Review, Switzerland]	Accepted. Statement now re-phrased
23693	6	3	44	3	45	Could the significance of the "Little is known... in future projections." be explained? [Government of Sweden, Sweden]	Accepted. Some information added from recent publications
14603	6	4	1	4	2	The following sentence should be modified as follows: "A level of change in system properties beyond which a system reorganizes, often abruptly, and does not return to the initial state even if the drivers of the change are abated or eliminated". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	We adopt the standard IPCC definition of abrupt.
786	6	4	1	4	9	It could help if more information about the connection between trade winds and the hiatus is added because it is a very important topic, especially for climate change suspects and deniers. [Mengxi Wu, United States of America]	We are advised that this topic will be covered in detail in AR6. There was not enough space here for the detailed treatment needed
22235	6	4	1	4	9	Key messages are clear in this paragraph, particularly for non-experts [Abram Nerilie, Australia]	Noted

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
31525	6	4	1	4	9	Can anything be said about how the variability, warming and cooling affects life in the ocean or ecosystem services related to the ocean? What are the consequences for humankind? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted. Some information, especially for MHWs included.
21197	6	4	2	4	2	"global warming hiatus" is missing a brief definition, it cannot be found in the annex/glossary either; it is a concept used different times in the chapter [APECS Group Review, Germany]	We are advised that this topic will be covered in detail in AR6. There was not enough space here for the detailed treatment needed
23281	6	4	2	4	2	very cautious reference to "hiatus" required due to "post mortem" of notion of hiatus in recent literature and to ensure coherency with AR6 WGI. [Valerie Masson-Delmotte, France]	We are advised that this topic will be covered in detail in AR6. There was not enough space here for the detailed treatment needed
22233	6	4	4	4	4	For consistency give name of current that transports water from Indian to Atlantic oceans (Agulhas) [Abram Nerilie, Australia]	Trying to keep statements short.
4589	6	4	5	4	5	Not clear why the basin wide warming in the Indian ocean should have caused increased ITF. Maybe rephrase. [The UBern Team Group Review, Switzerland]	Accepted and re-phrased
29755	6	4	5	4	6	Is the "cooling" that is mentioned actual cooling compared to preindustrial or is this just less warming, etc.? It seems to me important to provide a baseline period for the comparison for the phrase to be helpful. And is this really a cooling, or just greater upward mixing of deeper waters, so providing greater nutrients. It seems to me an indication of how this cooling is occurring is needed--it may just result from mixing and changes in vertical circulation in the ocean. [Michael MacCracken, United States of America]	Accepted. Trends clarified
1731	6	4	5	4	7	Is this anomalous warming in the Atlantic due to natural climate variability or climate change? [Nora Richter, United States of America]	Currently unknown.
23397	6	4	8	4	9	The author think that it has not been possible to attribute the extreme Pacific trade wind variations to either natural or anthropogenic factors. I am wondering if the level of confidence of this outcome can be given? [Rongshuo Cai, China]	Accepted.
5109	6	4	11	3	11	Ethiopia is assessed in 6.2 table but not shown in Figure 6.2 [Debra Roberts and Durban Team, South Africa]	Accepted. Now included on figure.
23283	6	4	11	4	27	to be more highlighted in SPM [Valerie Masson-Delmotte, France]	Noted
29757	6	4	11	4	27	Is there anyway to say if this feedback is positive or negative--that is, will further warming trigger a reduction in the AMOC and if so does this lead to a further reduction of the AMOC or do the changes induced by a reduced AMOC tend to create changes that start it up again? It would be helpful to indicate if such a change would cause a large and long-lasting flip (or as the next finding indicates, is a tipping element, in the climate system and so the world community should make sure to stay far from this condition, or if this would just be something like switching from an El Nino to La Nina, and over time it will come back. [Michael MacCracken, United States of America]	This issue is quite complex and is discussd in the main text. Too complex for the ES

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11287	6	4	12	4	14	You now state that a collapse is very unlikely, while in the FOD it was assessed unlikely, based on some CMIP5 models showing such collapse (Drijfhout et al. 2015, Sgubin et al. 2017). I don't see why you deleted the sentence "although there are more models available since the AR5 assessment that simulate a very rapid weakening." I don't agree with this new assessment as it reflects a degree of certainty that is not justified. For instance, CMIP5 projections were carried out without including GriS meltwater input and might be overly insensitive to climate change. I suggest revising back to "unlikely", also to avoid inconsistencies with the anticipated AR6 assessment. [Sybren Drijfhout, Netherlands]	This has been a complex issue but we have arrived at the final assessment by careful consideration of the most recent literature.
14605	6	4	14	4	14	Do models suggest this or are there other reasons for the confidence in this statement (i.e. non model forms of evidence)? Please clarify the evidence base for this. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Models and palaeo evidence
23695	6	4	14	4	19	Given that the assessment of this happening is very unlikely, it would seem strange to dedicate this much attention to possible consequences. What is the practical relevance? Instead, impacts of the very likely" weakening would be of much greater interest in the executive summary (and the SPM!). The very unlikely extreme outcome case can then be covered in the chapter text. [Government of Sweden, Sweden]	We consider this an unlikely but physically plausible scenario that is much discussed in the literature
31535	6	4	15	0		For clarity of terminology in WGI and II please avoid using the word impacts when talking about a sequence of physical changes elicited in the climate system. Impacts in the sense of WGII are effects of climate change on ecosystems and human systems and their infrastructure. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted and re-phrased
34041	6	4	15	4	17	Why mention the agricultural products affected by reduction of Sahelian rainfall but not those due to Asian monsoon rainfall? There are possibly more people directly affected by crop yields due to Indian monsoon rainfall variations than Sahelian. Maybe mention the number of people expected to be affected by both? Here is the opening sentence from a recent paper by Ghosh et al. (2016): ""India's agricultural output, economy, and societal well-being are strappingly dependent on the stability of summer monsoon rainfall, its variability and extremes."" Ghosh, S., Vittal, H., Sharma, T., Karmakar, S., Kasiviswanathan, K. S., Dhanesh, Y., et al. (2016). Indian Summer Monsoon Rainfall: Implications of Contrasting Trends in the Spatial Variability of Means and Extremes. PLOS ONE, 11(7), e0158670. <a href="https://doi.org/10.1371/journal.pone.0158670">https://doi.org/10.1371/journal.pone.0158670</a> [Government of United States of America, United States of America]	Rejected. This paper is not about the influence of AMOC slowdown
12867	6	4	20	4	22	I would not call the observed weakening between 2004-2017 "slight" (as you state later in the text it is 2.7 Sv between after 2008 and before 2008, with a mean of about 17 Sv that's more than 15%). [Levke Caesar, Germany]	Accepted and re-phrased

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
12869	6	4	20	4	22	It has been shown that even though the weakening trend of the AMOC between 2004-2017 is partly due to natural variability, there has been an overall decreasing trend since the 1950s (Caesar et al., 2018). I don't see the reason why you state this with only low confidence as there is evidence that the AMOC has weakened from both observations and models (that agree very well, see your Fig.6.9), but no evidence that it has not weakened. I would therefore remove the sentence "Some AMOC reconstructions... era (low confidence)" and replace it with a sentence like "It is very likely that the Atlantic Meridional Overturning Circulation (AMOC) has been weakening in recent decades given the detection of the cooling of surface waters in the north Atlantic (Caesar et al., 2018) and the projected decline of the AMOC by climate models to the observed surface warming (Bakker et al., 2016; Fig.6.9)." [Levke Caesar, Germany]	This has been a complex issue but we have arrived at the final assessment by careful consideration of the most recent literature.
1733	6	4	21	4	22	What about paleoclimate proxies from previous warm periods, do they show a weakening of the AMOC and/or any abrupt transitions that could help put this into context? [Nora Richter, United States of America]	This information is taken into account in the main text
22237	6	4	21	4	22	Meaning of "sea surface temperature fingerprints and proxies" isn't clear as written. [Abram Nerilie, Australia]	Accepted and re-phrased
22239	6	4	22	4	22	What is the "historical era"? Suggest consistency in terminology across report, could be achieved by rephrasing to "since the preindustrial" [Abram Nerilie, Australia]	Accepted and re-phrased
23697	6	4	22	4	25	What "more models available since" is not informative. As their result is still "very unlikely", they would appear to be very few, or less credible. Please redraft to add lucidity. [Government of Sweden, Sweden]	Accepted and re-phrased
11183	6	4	23	0		You should enter the meaning of the acronym AR5, proposed by the authors on page 6-4 to line 23, which was introduced in chapter 1, but it would be better to recall the meaning in each chapter [Maria Rosa Trovato, Italy]	Accepted and re-phrased
23699	6	4	25	4	26	It is not readily clear why the executive summary focuses on lack of impact and adaptation studies for a very likely outcome. Perhaps could be addressed in knowledge gaps instead. [Government of Sweden, Sweden]	Knowledge gaps addressed in 6.10
27859	6	4	29	0	30	Seems strange to say that a new element has been identified in some climate models with medium confidence. Isn't that just a factual statement? Also, what does it mean to call it a tipping element? [Ko Barrett, United States of America]	Accepted. This statement now deleted
1781	6	4	29	0	33	There is good evidence that changes in the SPG has consequences for the ecosystem - this could be included as an impact here, in addition to heatwaves [Mark Payne, Denmark]	This statement now deleted
15843	6	4	29	0	33	There is good evidence that changes in the SPG has consequences for the ecosystem - this could be included as an impact here, in addition to heatwaves [EUCE, Belgium]	This statement now deleted
29759	6	4	29	4	29	Should this say "new, potential tipping element" or is it really clear enough to be definitively found to be a tipping element? [Michael MacCracken, United States of America]	This statement now deleted
510	6	4	29	4	30	I don't think the word "tipping point" is the right one to use in this context. The Subpolar Gyre sees large variability on decadal timescales, typically due to the tug of war between temperature and salinity in determining density. A tipping point requires a switch in states that is near permanent (according to the IPCC dictionary), not the decadal change back and forth between states which is seen in the SPG. [Cecilie Mauritzen, Norway]	This statement now deleted

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23701	6	4	29	4	30	It is not clear how "identified in some climate models" and "medium confidence" relate to each other. Is the confidence level about the SPG or about it manifesting itself in some climate models? [Government of Sweden, Sweden]	This statement now deleted
1735	6	4	29	4	33	Is there any existing paleoclimate evidence from this region that would support or negate this statement during an analog warm time period? [Nora Richter, United States of America]	This statement now deleted
16431	6	4	29	4	33	This SPG paragraph would benefit from a clear expansion what the implications of a cooler SPG are on a larger scale. Please revise and extend. [Alexander Nauels, Germany]	This statement now deleted
21199	6	4	31	4	31	"smaller" potential climate change seems nonspecific, is it referred to ..."geographically smaller area, short time frames?, some examples may help the reader to understand the risk involved, the uncertainty of this may be linked briefly to the next paragraph on cascading impacts.... [APECS Group Review, Germany]	This statement now deleted
31527	6	4	31	4	31	Even if they are smaller, what potential climate impacts do you refer to? Please specify to avoid false assumptions. [Hans-Otto Poertner and WGII TSU, Germany]	This statement now deleted
25827	6	4	35	4	35	said: Climate change is increasingly exacerbating extrem events and causing multiple hazards that ...Suggestion: Climate change is modifying the extrem events in frequency, intensisty and periodicity .... [ELIZABETH SILVESTRE, Peru]	Accepted and re-phrased
23399	6	4	37	4	42	In the WGII AR5, the term "risk" usually refer to the risks of climate-change impacts. In this sentence and hereafter, I am wondering if the "impact" should be firstly mentioned, then "risk" in order. [Rongshuo Cai, China]	Accepted and re-phrased
1737	6	4	38	4	40	It is unclear from this description what the "compound events and cascading risks" are, especially with regards to the three examples given. I would suggest either making this statement more broad or elaborating on the risks associated with the three events. [Nora Richter, United States of America]	Not enough space to go into detail here. Tis is just a pointer to the 3 case studies
23703	6	4	38	4	40	What are the selection criteria for these "three examples"? They would not seem to be add much in the Executive Summary. [Government of Sweden, Sweden]	Just a pointer for the reader
23285	6	4	38	4	42	examples could be used in SPM [Valerie Masson-Delmotte, France]	Noted
31537	6	4	42	5	2	Can adaptation, costs of adaptation, limits to adaptation and residual risk be quantified in principal terms or for those specific examples? Otherwise, this should potentially be mentioned as a key gap in the ES. [Hans-Otto Poertner and WGII TSU, Germany]	Not enough space to go into detail here. Tis is just a pointer to the 3 case studies
23401	6	4	43	4	44	I would suggest the author follow the rules of SROCC LAM3 Treatment of uncertainty Guidance for IPCC authors. [Rongshuo Cai, China]	Accepted
15845	6	4	43	4	48	Emphasis on cost-effectiveness and DRR-adaptation integration made here are crucial. Should be kept in final draft, if possible in the same location (executive summary) [EUCE, Belgium]	Accepted and re-phrased
14607	6	4	44	4	44	Comment: certainly the costs of impact and recovery would definitely be higher in terms of human life costs (rather than monetised costs alone) [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5113	6	4	46	2	2	It will be useful to first consider the adaptation options in response to Extremes, Abrupt Changes and Managing Risks. The subsequent bullet on governance will then deal with the 'how' of implementing these adaptation options [Debra Roberts and Durban Team, South Africa]	These statements now re-phrased
23705	6	4	46	4	46	"alternative" to what? Today's? Different kinds? [Government of Sweden, Sweden]	These statements now re-phrased
34043	6	4	46	4	48	"Transformative governance and sustainable resilient pathways require alternative political/legal/institutional frameworks and participatory stakeholder integration that addresses combined climate change adaptation and disaster risk reduction (medium confidence)." This is the strangest sentence in the entire chapter. What is 'transformative governance'? Is that jargon from the social-science community? What is a 'sustainable resilient pathway'? Pathway to what? That these two nebulous concepts (transformative governance and sustainable resilient pathways) require 'alternative' [...] frameworks is literally nonsense. "Stakeholder integration"? There are probably some good ideas that the authors are trying to convey here but those ideas need to be stated more clearly, possibly over multiple sentences, and possibly not here in this chapter. The fact that 'medium confidence' is applied leads one to question relevance of any confidence statements in the chapter. [Government of United States of America, United States of America]	These statements now re-phrased
12905	6	4	46	4	57	Please check if you could concentrate this para to fewer lines. [Government of Germany, Germany]	Accepted and re-phrased
31529	6	4	46	5	2	Can any positive examples be given? [Hans-Otto Poertner and WGII TSU, Germany]	These statements now re-phrased
11729	6	4	49	4	51	The list problems leave out key problems e.g. a key issue around CAA and DRR integration is the different paradigms used in disciplinary practice Lawrence, J., et al., Adapting to changing climate risk by local government in New Zealand: institutional practice barriers and enablers. Local Environment, 2013: p. 1-23. Lawrence, J. and W. Saunders, The planning nexus between disaster risk reduction and climate change adaptation, in The Routledge handbook of disaster risk reduction including climate change adaptation J.M. I Kelman, JC Gaillard, Editor. 2017, Routledge: London & New York. p. 418-428. Training is not the problem it is only one of the solutions. I suggest the last problem is deleted and replaced with something like "capacity and capability deficits and differing professional practices e.g. reactive versus anticipatory." [Judy Lawrence, New Zealand]	Citations now included
30469	6	4	51	4	53	Specific and integrated management measures such as large-scale early warning systems, or global and multi scale monitoring and forecasting systems, can help to address the uncertainty of increasing extreme events and abrupt changes at different geographic scales. [Michele Capobianco, Italy]	These statements now re-phrased
30471	6	4	55	4	57	The evidence-base for the locations and size of economic and social impacts from extreme and abrupt changes is sparse, which hinders decision-makers from adequately assessing risks and vulnerabilities and developing and implementing adaptation options at the proper scales. [Michele Capobianco, Italy]	These statements now re-phrased

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22341	6	6	1	43	48	General comment: the integration of WG1 and WG2 material across each of the sections/topics is very helpful. In terms of risk management, however, the text here appears to be heavily focused on adaptation, and any messages of the benefits of climate change mitigation are lost. It would be good if more could be done here, in particular looking at the benefits (reduced risks/reduced costs) of a low emission future contrasted with a high emission future. [Abram Nerilie, Australia]	ES structure now changed to reflect the structure of the SPM
26083	6	6	1	7	44	Abrupt climate change is defined but not what how 'abrupt' changes in the ocean and cryosphere (p6, L3) are defined and thus what this chapter actually is about. It seems like the chapter deals with ANY changes no matter abrupt or not, e.g. is a decay of the Greenland ice sheet or the glacier shrinkage really 'abrupt'. It should be clearly defined what this chapter is about (e.g. define 'abrupt') [Regine Hock, United States of America]	Abrupt climate change is defined in 6.1.1. This is a 'standard' IPCC definition. Further information is given in the chapter on the implications for specific elements of the ocean and cryosphere
11185	6	6	9	0		You should enter the meaning of the abbreviation SREX, proposed by the authors on page 6-6 to line 9 [Maria Rosa Trovato, Italy]	Accepted - text revised
5107	6	6	9	6	9	Write "SREX" in full since this is the first usage in this chapter [Debra Roberts and Durban Team, South Africa]	Accepted - text revised
8155	6	6	17	0		Suggest inserting "to" instead of hyphen between "days" and "weeks" for consistency [Nina Hunter, South Africa]	Accepted - text revised
22245	6	6	19	6	19	"...introduced in Chapter 1". Give chapter 1 reference point here: CCB-1 and section 1.5 [Abram Nerilie, Australia]	Accepted - text revised
31735	6	6	21	0		Figure 6.1. The captions includes many examples that could be better placed in the figure itself in order to enhance the visual guidance that this figure can provide in terms of the content of the chapter. [Hans-Otto Poertner and WGII TSU, Germany]	Figure and caption significantly revised
31737	6	6	21	0		Figure 6.1. The referred framework seems to be lacking some sort of connection between elements in the figure. For example, are the abrupt changes and tipping points related to extremes, risks, etc..? And if so, can these connections be made in the figure? [Hans-Otto Poertner and WGII TSU, Germany]	Figure and caption significantly revised
31739	6	6	21	0		Figure 6.1. Concepts could be used more clearly here. For instance, the figure refers to "Extreme Hazards", but the caption only to "Hazards", similarly, The figure refers to "Cascading Impacts", but the caption refers to "Cascading Risks". [Hans-Otto Poertner and WGII TSU, Germany]	Figure and caption significantly revised
4591	6	6	21	6	21	Maybe put compound into brackets, as not only compound risks are assessed [The UBern Team Group Review, Switzerland]	Figure and caption significantly revised
11731	6	6	21	6	21	I like the compound risks in the middle but the Figure could convey the nature of cascading impacts in a more visually communicative way. Perhaps using a cone shape to show how cascading impacts become wider across all sectors of society and sectors. This is a critical Figure for policy makers and could do with some clever work even a 3D type of diagram. It needs expert input from designers. [Judy Lawrence, New Zealand]	Figure and caption significantly revised
1739	6	6	21	6	29	It is unclear how the text in the white boxes are related to the central figure. Similarly, it is not entirely clear how the caption relates to the actual figure. Consider add more information to the figure, e.g., under extreme hazards include tropical and extratropical cyclones, marine heatwaves, etc. [Nora Richter, United States of America]	Figure and caption significantly revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27867	6	6	21	6	29	The second sentence of the caption for this figure is not consistent with the information on the figure. Suggest that the text be moved to the main body of work or that the list of extremes, abrupt events, cascading risks are included in the figure. [Zelina Ibrahim, Malaysia]	Figure and caption significantly revised
27869	6	6	21	6	29	The caption mentions cascading risks while the figure has cascading impacts and compound risks and compound events. There should some consistency about the uses of these terms in the caption and in the figure and in the definitions in section 6.1.1. [Zelina Ibrahim, Malaysia]	Figure and caption significantly revised
788	6	6	22	6	22	It is not clear from the schematic what is the exact relationship between abrupt changes/tipping points and the compound risks. [Mengxi Wu, United States of America]	Figure and caption significantly revised
2457	6	6	22	6	22	What is "compound risk"? I don't think I have heard this term before. In the definition on page 7 compound risk seems to relate only to the hazard component. Why not adopt the extended risk framework from Zscheischler et al. (2018) in some way (including the definition of compound events given there, which was the result of an international workshop with 30+ experts in the field). [Thomas Wahl, United States of America]	Accepted - definition now changed
11493	6	6	22	6	22	It's unclear to me how the two boxes -- Abrupt Changes, Tipping points; Managing Risks, Resilience, Transformative Governance -- fit into the whole figure. [Anson Cheung, United States of America]	Figure and caption significantly revised
1867	6	6	22	6	29	the figure is not consistent with the text in ch. 6 or figure caption. First, in the text are described hazards that are not extreme in its nature. The authors should decide if they want to extremes only or hazards in general in the figure. The term "extreme hazards" is too narrow and not in the glossary. [Jana Sillmann, Norway]	Figure and caption significantly revised
1869	6	6	22	6	29	In the figure caption for fig. 6.1 it is written "cascading risks" which is inconsistent with the figure itself, where it is written "cascading impacts" and "compound risk". It seems in the general text as well as in the figures the authors use the terms "cascading", "compound", "risk", "impact" in an interchangeable manner. This should be avoided and terminology should be used consistent with clear definitions in the glossary. The term cascading risk is not in the glossary. [Jana Sillmann, Norway]	Figure and caption significantly revised
25587	6	6	23	0		I am not sure if a re-drawn figure from the AR5 only replacing 'Impact' by 'Compound Risks' does justice to the important concept of compound extremes. Please see i.e. Zscheischler et al. (2018) for a more elaborate conceptualization of compound events. [Schleussner Carl-Friedrich, Germany]	Figure and caption significantly revised
31539	6	6	23	0	29	This figure should be developed further and closely coordinated with potential further developments for the Cross-chapter box on risk in chapter 1. [Hans-Otto Poertner and WGII TSU, Germany]	Figure and caption significantly revised
10073	6	6	23	6	29	Figure caption 6.1 is difficult to follow. The key names given in the figure are not the same than those in the figure caption. When you describe terms, please use the same concepts than the figure does. For instance, when mentioned "Extreme discussed are tropical and extratropical cyclones; ..." you must say "Extreme Hazards are tropical and extratropical cyclones, ..." just like in the figure. Similarly, please use a coherent order of description, i.e., from left to right or vice-versa. [Elsa Arellano-Torres, Mexico]	Figure and caption significantly revised
22243	6	6	34	6	35	It isn't clear exactly what is meant in this sentence: "... And equivalent assessment provided in the SR15 report is discussed in Chapter 1." Suggest working with Chapter 1 to clarify intended meaning. [Abram Nerilie, Australia]	Sentence deleted

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29761	6	7	0	0		I'm generally concerned about the entries in the third column having to do with reversibility. I'm guessing that a number of the conclusions are based on evaluations made with the related aspects of the system remaining roughly as they are, so Arctic sea ice can reform now if forcing is reduced now, but if we allow overshoot and trigger and cannot stop loss of ice and large amounts of freshwater runoff from the Greenland Ice Sheet, is this still the case. On methane release from clathrates, it is not reversible in the sense that the methane will go back into the sediments--the statement presumably refers to being able to cool enough to reduce the rate of methane release back to previous levels--and it needs to be noted this would take time (likely many decades to centuries unless we intervened and did a flash cooling). Similarly, lowering the temperature is not going to put CO2 or CH4 releases back into the permafrost--it would hopefully lower the rate of emissions. On major loss from the Greenland and Antarctic ice Sheets, any restoration would go slowly, at least that is what is suggested by paleoclimatic records (so "many millennia" would seem a more accurate entry). [Michael MacCracken, United States of America]	This has now been clarified. More details may be found in the relevant chapters.
10075	6	7	0	9		Table 6.1. In the 3rd column called (from left to right) "Irreversibility if forcing reversed" there is not a specific "timescale" for all the System Components. In particular, it is confusing for "Marine heatwaves," "Glacier avalanches, surges and collapses," "Methane release," please clarify the approximate timescales. For instance, Marine heatwaves operate at daily or seasonal scale? Alternatively, the kind of heatwave should be clarified; Glacier avalanches surges and collapses are referred as isolated events or a sequence of them?; Why Methane release (both in the ocean and permafrost) is Reversible? What are the timescales? [Elsa Arellano-Torres, Mexico]	Timescales now better indicated
23287	6	7	0	9		Table to be revised to provide outcome of assessment as a function of time horizon and level of warming as done in Table 3.8 of SR15 for complementary / consistency. I cannot see how a confidence statement is provided without considering for what it applies (2, 3, 4°C of warming, with very different emission scenarios). Time horizon? By 2100, later? [Valerie Masson-Delmotte, France]	Would be useful but not enough literature.Done
22853	6	7	1	7	42	I imagine this has been discussed but all of that could be moved to the Glossary and referenced to save space [Raphael Kudela, United States of America]	Rejected - as there is often debate about these terms, we decided to include them for clarity
26079	6	7	1	7	42	It may be better to put those definitions into a chapter box, so that they are visually easier to find when flipping back or for referring to those definitions from other chapters. [Regine Hock, United States of America]	Rejected - boxes are generally reserved for cross-chapter issues or other special text e.g. case studies
638	6	7	1	9	1	This section is an excellent addition, as well as the following table. [Jenna Pearson, United States of America]	Noted
2709	6	7	7	7	9	Is long-term persistence such as several decades a necessary condition to define abrupt climate change, or just over several seasons or years? Further, how large a spatial scale will be quite typical or needed to cause substantial disruption to human and natural systems, regional or continental? [Thian Yew Gan, Canada]	We retain flexibility by adopting the standard IPCC definition
22027	6	7	19	7	22	"Abrupt" change takes place over a period of "a few decades or less", so to define "irreversibility" on the same sorts of timescales as the impact evolves over. This definition could mean that an "irreversible" impact could in fact be reversed over a period of 50-100 years? [David Schoeman, Australia]	We adopt the standard IPCC definition

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14623	6	7	24	7	25	The following sentence should be modified as follows: "Severe tropical cyclones (TCs) and extratropical cyclones (ETCs) pose major threats to society as a whole, but will affect particularly public infrastructure, coastal communities and marine activities due to damaging winds..." [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	This comment seems misplaced.
8157	6	7	29	0		Three terms are mentioned but I see four terms listed above? [Nina Hunter, South Africa]	Accepted - text revised
4593	6	7	29	7	29	should be 'four' instead of 'three' [The UBern Team Group Review, Switzerland]	Accepted - text revised
22247	6	7	29	7	29	four terms, not three [Abram Nerilie, Australia]	Accepted - text revised
31413	6	7	29	7	30	Please add definitions for ecological and human systems for balance, and also consider that extreme climate events may not always lead to extreme impacts - see Smith 2011 J Ecology 99, 651-655, and Smith 2011 J Ecology 99, 656-663 [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
11733	6	7	29	7	32	The notion of tipping point has been extended to refer to human systems and in particular to adaptation options. This I support . However to avoid confusion between natural system tipping points and human system tipping points it would be helpful to call the latter "adaptation thresholds". In my experience and as embodied in the New Zealand national guidance this distinction better communicates the concept to decision makers who think of tipping points as primarily about physical and natural systems. Ref Bell, R., et al., Coastal hazards and climate change: Guidance for local government. Ministry for the Environment Publication ME-1341. 2017, Ministry for the Environment: Wellington. [Judy Lawrence, New Zealand]	We have reached a standard definition across AR6 for this term
4595	6	7	30	7	31	Rephrase to ' For example, gradual physical climate change may cause irreversible' [The UBern Team Group Review, Switzerland]	We adopt the standard IPCC definition
4597	6	7	32	7	32	Give example for a tipping point within a governance structure. [The UBern Team Group Review, Switzerland]	Discussed further in the chapter
14621	6	7	36	6	37	The definition of 'Compound Risk' is unclear here. The definition on page 43, line 55-56 is better. Please revise for consistency throughout chapter. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Definition has been revised accordingly.
1871	6	7	36	7	42	The description of compound risk is inconsistent with the fig 6.1. in the description risk is "characterized by single extreme events or multiple coincident or sequential events". The latter don't have to be extreme to my understanding, so the term "extreme hazards" in Fig. 6.1 is misleading and should be replaced by "hazard" as in the glossary. [Jana Sillmann, Norway]	Definition has been revised accordingly.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11735	6	7	39	7	42	Excellent to include cascading impacts. The definition does not however describe what it is, only when it occurs. Add something like the following at the beginning of the definition. " ..are impacts that propogate from a primary climate change impact affecting wider and wider sectors in society and the economy" It is also not clear how the word "vulnerability" is being used. Vulnerability is an underlying condition of systems whether fragility of infrastructure or or condition of people e.g. poor, unhealthy, no access to resources. It is the impact that is exacerbated by these conditions. Further nuancing of this definition would be helpful for decision makers to understand the importance of considering cascading characteristics of the impacts. [Judy Lawrence, New Zealand]	Definition has been revised accordingly.
31415	6	7	45	0		Where is the section introducing extremes?, in 6.3 the chapter launches into a section on cyclones which are not included in 6.2 [Hans-Otto Poertner and WGII TSU, Germany]	Now added
14609	6	7	50	9	1	Table 1 has a number of oddities, possibly because it includes systems (like permafrost) that are not analysed in this chapter. Either cut it down, so it only reflects the systems actually analysed in this chapter, or get the other chapter authors to check it carefully. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	The table is based on information in other chapters and has been check by the relevant authors
14611	6	7	50	9	1	Table 1 - methane release from ocean hydrates: should be irreversible [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Could be reversible in 1000s of years
14613	6	7	50	9	1	Table 1 - marine heatwaves increase: the abrupt and irreversible labels: I suspect these refer to the impacts of the heatwaves, rather than the increase in heatwaves per-se? If so, change the label to something like, 'impacts of increased marine heatwaves' [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	These refer to the hazard not the impact
14615	6	7	50	9	1	Table 1 - it's unclear why there are two separate rows for Methane and CO2 release from permafrost. Why is methane release from permafrost labelled 'Reversible'? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	The table is based on information in other chapters and has been check by the relevant authors

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14617	6	7	50	9	1	Table 1 - the 'late 21st century rcp8.5' label in the abrupt column is too specific. Suggest it's removed. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Needs to be highlighted as only relevant for this scenario
14619	6	7	50	9	1	Table 1 - I think that the impacts of permafrost thermokarst are more in terms of potentially large carbon emissions. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	The table is based on information in other chapters and has been checked by the relevant authors
12907	6	7	51	0		Table 6.1: This is an extremely helpful table. However it is not entirely clear, what a confidence statement without a likelihood statement is supposed to mean with regard to the hazard described. While it is clear, the e.g. "likely, medium confidence" translates into the authors having medium confidence in their/the literature's assessment that it is likely that sth will happen over the course of the 21st century, a standalone confidence statement does not provide that kind of guidance. Please revise the entries in a way that a "confidence only" statement informs the reader more precisely what it is the authors express confidence for. [Government of Germany, Germany]	More details can be found in the relevant chapter sections
12909	6	7	51	0		Please add an assessment of AMOC slowdown to the existing one on AMOC collapse. Even if the collapse is unlikely, a slowdown would have considerable impacts as well. Other lines in this table do also describe events that could be characterized as deterioration rather than abrupt change, so we do not see a reason why the entry here should be confined to the AMOC collapse. [Government of Germany, Germany]	See ES statements
32501	6	7	51	7	54	(This table does not have lines so it is difficult to be more specific with the location of my comment here:) In Table 6.1 there is the change in component "Rapid permafrost thermokarst" (page 9): This process is irreversibly (change from unknown to irreversible). Thermokarst is the process of melting large volumes of ground ice, which had accumulated for millennia to tens of millennia in the ground; once melted and the surface has subsided and topography changed, it is impossible to reverse this process on human-relevant time scales as formation of such large ground ice volumes requires millennia and certain climate conditions. Furthermore, hydrologic processes and dynamics change with ongoing thermokarst, perpetuating the thaw dynamics (self-reinforcement). [Guido Grosse, Germany]	The table is based on information in other chapters and has been checked by the relevant authors
4221	6	7	51	9	1	there is not any description about Lakes and the largest lakes in the world, especially Caspian sea level fluctuation and its effects on ecosystem and Coastal human society [Behzad Layeghi, Iran]	Deemed to regional
5497	6	7	51	9	1	there is not any description about Lakes and the largest lakes in the world, especially Caspian sea level fluctuation and its effects on ecosystem and Coastal human society [rashidian leila, Iran]	Deemed to regional

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5557	6	7	51	9	1	there is not any description about Lakes and the largest lakes in the world, especial Caspian sea level fluctuation and its effects on ecosystem and Coastal human society [Government of Iran, Iran]	Deemed to regional
22249	6	7	51	9	1	Wherever possible, it would be good if Table 6.1 could include likelihood/confidence assessments based on low and high emission scenarios (e.g. have two final columns - one for end-of-century assessment under RCP2.6 and one for RCP8.5). It is important to present the choices that are made/changes committed to depending on the emission scenario followed. It would also be helpful to be more specific (and use consistent language) for the time frame considered. I assume that this is end-of-century, but it is ambiguous in the table column title. [Abram Nerilie, Australia]	Agreed but not necessarily possible based on information from other chapters
26081	6	7	51	9	1	Table last line is vague and unclear: what is 'switch to different state'. What is state? What variable? What's 'communities' here? Why ust glacier? There are many changes in snow-fed river basins? Is this just about ecosystems? [Regine Hock, United States of America]	More details can be found in the relevant chapter sections
26085	6	7	51	9	1	The first column is not really consistent: The header 'Change in system component' then either it should consistently just mention the variable (such as 'ocean acidification') in each row or the change plus variable (e.g. Arctic sea-ice retreat). Currently this is a mix and makes it confusion. [Regine Hock, United States of America]	Sorry - but we try to condense a lot of information here
26087	6	7	51	9	1	Sea-ice decline may be better than retreat, since the changes include various variables (not just extent). Also why is sea-ice not under cryosphere? [Regine Hock, United States of America]	More details can be found in the relevant chapter sections
26089	6	7	51	9	1	It is not really clear what the last column is supposed to refer to. Is this the likelihood that what is written in column 1 will happen or is that the confidence that we have that column 2 is true, i.e. if this is abrupt at all. The table is a great idea but needs to identify a clear logic which I miss. For example, the table suggests (correctly) that Greenland ice sheet decay is not abrupt but what does 'low confidence' refer to. Do you have low confidence that GIS decay is not abrupt? If so, this should be 'virtually certain' that this does not happen abruptly in the 21st century. If GIS decay is not abrupt, why is it in the table which summarizes abrupt changes (East Antarctica is not in the table either presumably for that reason). [Regine Hock, United States of America]	Sorry - but we try to condense a lot of information here
29111	6	7	51	9	1	Because there are no line markers for this Table, proposed changes are noted below are in connection with the individual topics. These are also identified in this Comment Excel file, Cells D and F by their row in Table 6-1, and with their topic headlines in the below comments. [Pam Pearson, Sweden]	Noted
1755	6	7	55	0		The mixing of confidence and likelihood terminology here is very confusing. Please either provide both, or just stick to one of the two. In particular the Sub-Polar Gyre cooling having "medium confidence" (of what?) is unclear how this should be interpreted [Mark Payne, Denmark]	More details can be found in the relevant chapter sections
15847	6	7	55	0		The mixing of confidence and likelihood terminology here is very confusing. Please either provide both, or just stick to one of the two. In particular the Sub-Polar Gyre cooling having "medium confidence" (of what?) is unclear how this should be interpreted [EUCE, Belgium]	More details can be found in the relevant chapter sections
31417	6	7	55	0		focus the first column on the hazard only, the addition of two lines for ecosystems at the end of cryosphere section is not logical [Hans-Otto Poertner and WGII TSU, Germany]	Sorry - but we try to condense a lot of information here



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31419	6	7	55	0		suggest to separate column 4 into two: consequences for climate system and for ecosystems and human systems [Hans-Otto Poertner and WGII TSU, Germany]	This was found to be too difficult
31421	6	8	0	0		ocean row 4, column 4: include loss of ice-dependent ecosystems? [Hans-Otto Poertner and WGII TSU, Germany]	More details can be found in the relevant chapter sections
31423	6	8	0	0		ocean row 5, column 4: specify through feedback to climate system [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
31425	6	8	0	0		ocean row 5, column 3: is this considered reversible because methane has a short life in the atmosphere, please specify [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
31427	6	8	0	0		cryosphere row 1, column 3: is this considered reversible because methane has a short life in the atmosphere?? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
31429	6	8	0	0		cryosphere row 1, column 4: Specify through climate feedback [Hans-Otto Poertner and WGII TSU, Germany]	Accepted
13187	6	8	0	8		The text under impacts of Ocean acidification on natural and human impacts (Table 6.1; Row-8; column-4) should indicate the level of changes in Growth, development, calcification, survival and abundance of species; e.g. from algae to fish. For example, are the impacts minor, moderate, major, significant etc? Is it also possible to indicate whether positive or negative impacts? [GEOFFREY EVANS OWINO OGUTU, Kenya]	More details can be found in the relevant chapter sections
790	6	8	1	8	1	Methane release from ocean subsurface hydrates is neither abrupt nor irreversible according to the table, so I do not know why it is included here. [Mengxi Wu, United States of America]	It is a topic of discussion in the literature
2711	6	8	1	8	1	I wonder why methane or CO2 released from permafrost are categorised as low confidence only? Cory et al (Science, 2014) There's so much carbon stored in northern permafrost soils that even if, say, 10% of that carbon is released instead of washed into seas, conservative estimate shows that it could still raise atmospheric CO2 levels by 75 to 80 ppm? [Thian Yew Gan, Canada]	The table is based on information in other chapters and has been check by the relevant authors
21601	6	8	1	8	1	I do not agree that Methane release from permafrost is reversible – unless you look at very long time scales [Stephan Gruber, Canada]	The table is based on information in other chapters and has been check by the relevant authors
22251	6	8	1	8	1	Arctic sea-ice retreat: is this really demonstrated in the scientific literature to be "reversible within years". I would have expected ocean warming to cause a long-term commitment to Arctic sea ice loss than this. [Abram Nerilie, Australia]	Accepted and changed to decades-centuries
22253	6	8	1	8	1	What is the reversibility timescale for marine heatwaves? Again I would have expected ocean heat content to make this a long-term commitment [Abram Nerilie, Australia]	Accepted and changed to decades-centuries
22255	6	8	1	8	1	Reference to CCB-2 for west Antarctic ice sheet collapse, Greenland ice sheet decay, and ice-shelf collapses isn't correct. CCB-2 (Chapter 1) is on governance. [Abram Nerilie, Australia]	Corrected
29113	6	8	4	8	4	Arctic sea ice. Add Col 1, "and loss of multi-year ice." This is a major change to the Arctic Ocean ecosystem, with far more impact on regional species than mere extent per se. Add Col 4, "impact on biodiversity (high confidence)." [Pam Pearson, Sweden]	More details can be found in the relevant chapter sections
29115	6	8	5	8	5	Methane hydrates. See comment below in Row 81, Methane release from Permafrost (applies also here but as this is a lower likelihood and confidence change, applies to greater degree below). [Pam Pearson, Sweden]	The table is based on information in other chapters and has been check by the relevant authors
29117	6	8	7	8	7	Ocean acidification. Degree of irreversibility (around 70,000 years for buffering from rock weathering) much higher than other dynamics noted on millennial timescales, therefore suggest change to Col 3, "...irreversible for tens of millennia at depth." [Pam Pearson, Sweden]	The table is based on information in other chapters and has been check by the relevant authors

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29119	6	8	8	8	8	Methane release from permafrost. Categorizing this as "reversible" is not correct, certainly not as regards the terminology used, eg "release of methane," because the released methane is not re-fixed in the soil as methane, at least not on the timescales noted for other processes in this table. If the meaning instead is that the impact of the methane release is reversible because of methane's relatively short lifetime in the atmosphere (which is implied by the next entry, CO2 release from permafrost), this also is incorrect because, while the methane itself breaks down in a variety of chemical processes, a large portion becomes CO2 (as well as contributing to ozone formation, etc.). The main and most important point however is that the RELEASE is reversible only on very long time scales -- permafrost formation and related carbon fixation to today's levels (let alone pre-industrial) would take centuries to millennia of lower temperatures than pre-industrial to be "restored." [Pam Pearson, Sweden]	The table is based on information in other chapters and has been check by the relevant authors
29121	6	8	8	8	9	Methane release from permafrost, CO2 release from permafrost. Carbon release at increased levels is already being monitored annually in many polar and mountain permafrost regions, so Col. 5 should read, "Very likely (high confidence)." The potential for "abrupt" release is low, but the potential for "irreversible" release is high confidence based already on observation. If there is confusion as to whether Col 5 (Projected likelihood) refers to likelihood of an abrupt event, or of an irreversible process, suggest this be split into two columns. [Pam Pearson, Sweden]	The table is based on information in other chapters and has been check by the relevant authors
29123	6	8	8	8	9	Suggest new entry, "Permafrost collapse." Col 2 "Yes", Col 3 "Irreversible for centuries to millennia," Col 4 "Infrastructure damage, population displacement," Col 5 "Very likely (high confidence)," because it already is occurring at current levels of warming. This irreversible process is distinct from that of carbon release, above. An alternative approach might be a single integrated entry encompassing all three issues of methane and CO2 release as well as physical collapse, titled "Permafrost thaw" and including all impacts and characteristics noted above. [Pam Pearson, Sweden]	We did not add this due to lack of information in other chapters
31431	6	9	0	0		Cryosphere row 11. column 1: add as an impact not a hazard, same for row 12 [Hans-Otto Poertner and WGII TSU, Germany]	Now indicated.
8159	6	9	0	0		Suggest ordering the table from section 2.3 to section 6.7 as it is a more logical flow and may assist the reader [Nina Hunter, South Africa]	Now indicated.
21201	6	9	0	9		Consider to add "human and animal disease outbreaks" in the row of Impacts related to Change in biodiversity in high mountain areas [APECS Group Review, Germany]	The table is based on information in other chapters and has been check by the relevant authors
28485	6	9	1	0		Please add a figure similar to Fig SPM.5. In addition, a table or additional figure should be added including the economic impacts of tropical cyclones on the country level with respect to the size of the island economies. [Government of Saint Lucia, Saint Lucia]	Such a figure was not possible
29125	6	9	1	9	1	Should this not read, "Rapid permafrost thermokarst thaw"?. Like permafrost, this would be similarly irreversible for centuries to millennia; and a large impact is "release of CO2 and methane" (though primarily in the form of methane given wet conditions), per Walter Anthony et al (2018), cited Row 52, above. [Pam Pearson, Sweden]	The table is based on information in other chapters and has been check by the relevant authors
4223	6	9	3	10	6	It may be added to the report that Probability of occurrence the Tropical cyclone will increase in the regions that has not recorded, such as Guno cyclone that happened in Hurmuz Strait and Persian Gulf [Behzad Layeghi, Iran]	Noted
5499	6	9	3	10	6	It may be added to the report that Probability of occurrence the Tropical cyclone will increase in the regions that has not recorded, such as Guno cyclone that happened in Hurmuz Strait and Persian Gulf [rashidian leila, Iran]	Noted

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5559	6	9	3	10	6	It may be added to the report that Probability of occurrence the 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, Iran]	Noted
29127	6	9	3	9	3	Suggest an additional and corresponding entry to the "High mountain" entry: "Change in biodiversity in high polar regions (Section 3.2, 3.4", Col 2 "Yes", Col 3, "In many cases irreversible (eg, extinction of species)", Col. 4, "Impacts on fisheries, local impacts on ecosystems and ecosystem services", Col 5, "Very likely (high confidence)". This could also be integrated into the High mountain entry, but is a bit different especially with impact of disappearance of virtually all multi-year ice as a unique ecosystem (in addition to the "increased" biodiversity noted in Sections 3.2 and 3.4, that however is related to spread of more southern species that are already widespread elsewhere and displacing native species -- eg greater numbers of species will be present in the Arctic, but global biodiversity will decrease as polar species decline or are lost). [Pam Pearson, Sweden]	We did not add this due to lack of information in other chapters
22259	6	9	3	9	4	The structure of section 6.3 doesn't seem quite right. The title of 6.3 is focused on tropical and extratropical cyclones, but the information in sections 6.3.1, 6.3.2, Figure 6.2 and Table 6.2 is more generally about extreme weather events and event attribution methods (including MHWs, coral bleaching and sea ice change). Suggest either changing title of 6.3 heading, or seperating 6.3 into two sections, 1 as a general summary of extreme weather, and the second focusing on cyclones. [Abram Nerilie, Australia]	This point has been addressed by movingTable 6.2 and Figure 6.2 to section 6.2.
11499	6	9	6	21	45	I think it is worth discussing the understanding, challenges, and risks associated with Rapid intensification (RI) of hurricanes, because they are hard to forecast and can pose significant impacts to coastal communities and hard for implementing accurate risk management measures. Some recent papers: Zhao et al. 2018 doi: 10.1175/JCLI-D-18-0029.1 ; Balaguru et al. 2018 doi:10.1029/2018GL077597 ; Emanuel 2017 doi: 10.1175/BAMS-D-16-0134.1 ; Bhatia et al. 2018 doi: 10.1175/JCLI-D-17-0898.1 ; Kossin 2017 doi: 10.1038/nature20783 [Anson Cheung, United States of America]	this is now addressed in the TC section
14625	6	9	8	9	9	We suggest revising the following sentence as follows: "However in coastal recession-permitting simulations, results indicate a reduction in tidal range due to changes in the period of oscillation of the basin under the changed coastline [DEL: conditions] morphology" [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	wrong page cited but change has been made to text in Waes and extreme sea levels section
31433	6	9	13	9	13	but not necessarily how devastating the cyclone is in terms of damage [Hans-Otto Poertner and WGII TSU, Germany]	This sentence has been removed due to the need to shorten the section overall
23289	6	10	0	10		Missing assessment of confidence in attribution methods. Will be considered in depth in AR6 WGI. I suggest to get in touch with CLAs of ch11 to make sure that there is coherency. [Valerie Masson-Delmotte, France]	TO DO!!
31435	6	10	8	0		This is a general section on extremes attribution that should come before the section on cyclones [Hans-Otto Poertner and WGII TSU, Germany]	This section on extremes attribution has now been moved to section 6.2
5501	6	10	8	10	39	For better study and monitoring of atmospheric phenomena in marine and ocean environments is suggested that Global Oceanic monitoring of climate change will be expand to nearby seas such as Persian Gulf ( with regarding to unic ecosystem) [rashidian leila, Iran]	taken as a comment - no change

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
5561	6	10	8	10	39	For better study and monitoring of atmospheric phenomena in marine and ocean environments is suggested that Global Oceanic monitoring of climate change will be expand to nearby seas such as Persian Gulf ( with regarding to unic ecosystem) [Government of Iran, Iran]	taken as a comment - no change
4599	6	10	8	10	40	The attribution methods and ideas have been introduced in the chapter 1 (Framing) already. Maybe skip this entire section. [The UBern Team Group Review, Switzerland]	This section has been shortened given that chapter 1 offers a brief description of event attribution
11497	6	10	8	16	1	This subsection seems a bit odd in this place, it discusses about extreme events in general, but not TCs and ETCs. So I don't think it really fits in this section. It might be better to put it somewhere else [Anson Cheung, United States of America]	This subsection has now been moved to section 6.2
29763	6	10	10	10	10	The phrasing here makes it seem as if there can only be one cause of an extreme event and so this is a yes or no issue rather than there being a few contributors that could be contributing to an effect, so a storm surge coincident with high tides being especially extreme due to the tides and sea level rise. This either/or, all or nothing phrasing needs adjustment. [Michael MacCracken, United States of America]	The sentence has been deleted
1873	6	10	10	10	11	The statement that "the ability to attribute extreme events to climate change is important for [...], decision making and adaptation planning" is highly questionable. If you want to keep it you need to find and refer to papers that actually show or provide evidence for this statement. The statement cannot be supported by papers trying to promote event attribution and hence speculating about its usefulness. According to a recent PhD thesis (partly published or submitted) by Aglae Jezequel doing a literature review and interviews (with particular decision makers in mind) indicates the limitation of the usefulness of event attribution apart from awarness raising or building. [Jana Sillmann, Norway]	The sentence has been deleted
12911	6	10	10	10	11	Is the statement "the ability to attribute extreme events to climate change is important for [...], decision making and adaptation planning" supported by literature? Please add references that indicate that event attribution is being used or requested for these purposes. While we agree that event attribution is very helpful to raise awareness, and certainly has scientific value, it is not clear to us how exactly it is being useful beyond political and science communication. [Government of Germany, Germany]	The sentence has been deleted
2713	6	10	32	10	35	The general increase in sea surface temperature SST and possibly the increase in ocean acidity in recent years attributed to the rising concentration of CO2 and Methane could contribute to the more frequent and severe occurrences of extreme climate events? [Thian Yew Gan, Canada]	noted - the sentence has been modified to make it clearer what aspects of ocean change are affecting extreme climate events

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23403	6	10	32	15	1	I would suggest that Figure 6.2 and Table 6.2 mention that Marine Heat Wave event (the record-breaking warming event) happened in the East China Seas during August 2016. e.g., Tan H, Cai R. What caused the record-breaking warming in East China Seas during August 2016? Atmos Sci Lett. 2018; e853. <a href="https://doi.org/10.1002/asl.853">https://doi.org/10.1002/asl.853</a> . Actually, the Marine Heat Wave event between July and August in 2018 also attacked the East China Seas including Bohai Sea again and caused severe culture sea cucumber death in large area and huge economic loss, although there was not published paper to report this MHW event in 2018. However, more and more extreme SST events occurred in the coastal China seas in the past years, e.g., there are similar paper as below, 1) Li L, Fan W, Luo et al., Climatic Characteristic of Sea Surface Temperature and Air Temperature over the China Seas in 2017, Marine Science Bulletin, 2018 (3), 296-302. Doi:10.11840/j.issn.1001-6392.2018.03.007 (in Chinese); 2) Pei Y H, Liu X H, He H L. Interpreting the sea surface temperature warming trend in the Yellow Sea and East China Sea. Science China Earth Sciences, 2017( 60): 1558-1568, doi:10.1007/s11430-017-9054-5. Therefore, MHW events in the Pacific marginal seas such as in the in the coastal China seas should not be neglected. [Rongshuo Cai, China]	record breaking MHW event in East China Sea (Tan and Cai, 2018) is now included
10077	6	10	35	10	36	The relationship between "marine heatwaves and associated coral bleaching events" is confusing if Marine Heatwave is not defined first. For instance, the paper by Lewis and Mandella, 2018, does not relate coral bleaching to heatwave; they allude coral bleaching to "anomalously high sea surface temperature and the accumulation of thermal stress," which is not entirely adequate to the marine heatwave (MHW) definition by Hobday et al. (2016) i.e., "a prolonged discrete anomalously warm water event". [Elsa Arellano-Torres, Mexico]	reference MHW section and delete 'associated'
22257	6	10	36	10	38	The offsetting effect from ozone recovery on the SAM/westerlies is only present in Southern Hemisphere spring and summer months, but in other months the GHG-forced poleward movement is expected to dominate. This isn't clear from current phrasing of the sentence. [Abram Nerilie, Australia]	rewrite last sentence in ETC blocking section referring to Shaw et al, (2016)
22163	6	11	0	15	0	"Figure 6.2 miss out extreme events in South Asia and along the Indian coast like Tsunami. Table 6.2 mentions Cyclone Nilofar causing heavy rainfall on western Indian coasts, however, this event is not reflected in Figure 6.2." [NAYANIK SINGH, India]	Tsunami's are not climate events and so are not covered in this report. Figure 6.2 has been fixed up
25707	6	11	0	15	0	"Figure 6.2 do not include extreme events like Tsunami. Table 6.2 mentions Cyclone Nilofar causing heavy rainfall on western Indian coasts, however, this event is not reflected in Figure 6.2." [Government of India, India]	Figure 6.2 has been fixed up
8161	6	11	0	0		I realise that this is a selection (not a sampled in some way) but I still feel that the lack of extreme events over Africa and Asia is glaring. Why is this? Are there few extreme events on these continents? Have very few studies been conducted on extreme events on these continents? I think it would be helpful to state why so few extreme events are recorded for these locations. [Nina Hunter, South Africa]	We have sought to find additional studies that apply event attribution to extreme events in Africa and Asia. We also conclude that event attribution studies over this region are lacking
5503	6	11	0	0	11	Some of the Atmospheric Phenomenon such as Coral bleaching in Persian Gulf is not shown in the 6.2 Figure, Which is due to increased water temperature. [rashidian leila, Iran]	we did not find peer reviewed literature that had applied event attribution to coral bleaching in the Persian Gulf
5563	6	11	0	0	11	Some of the Atmospheric Phenomenon such as Coral bleaching in Persian Gulf is not shown in the 6.2 Figure, Which is due to increased water temperature. [Government of Iran, Iran]	we did not find peer reviewed literature that had applied event attribution to coral bleaching in the Persian Gulf

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
4601	6	11	0	11		Why not including figure 6.2 and table 6.2 in section 6.2, as section 6.3 deals with tropical and extratropical storms only, but the figure and table includes many more examples of extreme events. [The UBern Team Group Review, Switzerland]	thank you for this suggestion. We have now moved Figure 6.2 and Table 6.2 to section 6.2
8693	6	11	0	11		In figure 6.2, Please insert coral bleaching over Persian Gulf. (Reference:Bento, R., Hoey, A.S., Bauman, A.G., Feary, D.A. and Burt, J.A., 2016. The implications of recurrent disturbances within the world's hottest coral reef. Marine pollution bulletin, 105(2), pp.466-472.) [Government of Iran, Iran]	Figure and Table 6.2 are highlighting studies that have applied the methodology of event attribution. the Bento et al study does not apply event attribution
8695	6	11	0	11		in figure 6.2, Please insert cyclone symbol over theOman Sea.(References: Evan, A.T. and Camargo, S.J., 2011. A climatology of Arabian Sea cyclonic storms. Journal of Climate, 24(1), pp.140-158.;Fritz, H.M., Blount, C.D., Albusaidi, F.B. and Al-Harthy, A.H.M., 2010. Cyclone Gonu storm surge in Oman. Estuarine, Coastal and Shelf Science, 86(1), pp.102-106.) [Government of Iran, Iran]	this study provides a climatology of oman cyclones but does not apply event attribution which is what we are trying to communicate in Figure 6.2
8697	6	11	0	11		In table 6.2: Please insert a row about "cyclone Gonu, 2007". Region: Arabian sea, Oman Sea. Severe hazard: The strongest storm in the recent record was super cyclonic storm Gonu, which formed in early June 2007 and made landfall in both Oman and Iran.Impact, costs: The cyclone caused 50 deaths and about \$4.2 billion in damage (2007 USD) in Oman. Attribution to anthropogenic climate change: This cyclone had an unusual path, traveling much further west and north than the typical cyclone. Significant wave heights in excess of 4 m were measured at Chabahar located on the south coast of Iran bordering the Oman Sea. ( References: Dibajnia, M., Soltanpour, M., Nairn, R. and Allahyar, M., 2010. Cyclone Gonu: the most intense tropical cyclone on record in the Arabian Sea. In Indian Ocean tropical cyclones and climate change (pp. 149-157). Springer, Dordrecht.; Coumou, D. and Rahmstorf, S., 2012. A decade of weather extremes. Nature climate change, 2(7), p.491.; Evan, A.T. and Camargo, S.J., 2011. A climatology of Arabian Sea cyclonic storms. Journal of Climate, 24(1), pp.140-158.) [Government of Iran, Iran]	This event has been added
8699	6	11	0	11		In figure 6.2, Please insert cold or snow storm in the southern coast of the Caspian Sea. (lake effect snow related to warm water). (Reference: Ghafarian, P., Pegahfar, N. and Owlad, E., 2018. Multiscale analysis of lake-effect snow over the southwest coast of the Caspian Sea (31 January–5 February 2014). Weather, 73(1), pp.9-14.) [Government of Iran, Iran]	While this is an interesting event, the paper describes the synoptic conditions leading to the LES event but does not analyse whether any of the elements (e.g. high lake temperatures or the blocking system over Europe causing the persistence of this synoptic system) is linked to climate change so it has not been included
16549	6	11	0	11		The Mekong Delta is considered as one of the most extreme vulnerable deltas to climate change in the world. But It is missed in this Figure (Figure 6.10) [Hoang Anh Le, Vietnam]	We appreciate this but felt it to be out of scope for this oceans and cryosphere report
23291	6	11	0	11		Table 6.2 and Figure 6.2 are sometimes inconsistent, to check. Missing assessment of confidence in Table 6.2 depending on method used to reach conclusion (evidence, agreement). [Valerie Masson-Delmotte, France]	The table and figure entries have been checked and revised for consistency. The purpose of the table is to illustrate that event attribution is increasingly being applied to extreme events with an ocean or cryospheric link and collectively these show that climate change is increasingly playing a role in extreme and compound events.
8171	6	11	0	15		Much of the cited information in column 4 is not referenced (e.g. page 13, column 4, row 8) [Nina Hunter, South Africa]	reference added

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
10235	6	11	0	15		An extreme rainfall icon was placed over southern China in Figure 6.2 but no relevant discussion can be found in Table 6.2. [SAI MING LEE, China]	icon removed
22571	6	11	0	15		Suggest clarifying the symbols representing 'marine heatwaves' and 'coral bleaching' shown in Figure 6.2 and then expanded in Table 6.2. Readers may make the incorrect assumption that coral bleaching is somehow disconnected from marine heatwaves, and that marine heatwaves might not lead to coral bleaching.  This is illustrated by the fact the Great Barrier Reef is represented by a coral bleaching symbol but the 2011 marine heatwave event in Western Australia, which also caused widespread coral bleaching, is just represented by a marine heatwave symbol. Suggest either a change in the text around what these two symbols represent, or use the coral bleaching and note that this is caused by marine heatwaves affecting corals and coral reefs. [Government of Australia, Australia]	To avoid confusion we have removed icons for mangrove dieback and coral bleaching and use icons related to the physical events
11495	6	11	1	11	1	There's an extreme rainfall symbol in Southeastern China, but there's no such event discussed in Table 6.2 [Anson Cheung, United States of America]	icon removed
11843	6	11	1	11	1	Increased flooding in Bangladesh, drought in Australia (especially during El Nino) and drought in Mediterranean due weakened AMO. [William Lorenz, Australia]	Table 6.2 includes a selection of events for which there has been an event attribution study undertaken and a link to climate change has been found. It is not clear from the comment whether these events have had event attribution studies done.
22855	6	11	1	11	1	Just a comment, but you may want to state in the figure caption that this only includes extreme events listed in the table. I could see this being used by climate change deniers to point out that (for example) there are no extreme events in Peru and Chile, for example, or most of western Africa [Raphael Kudela, United States of America]	The figure caption currently states this so we do not think a change is required
27871	6	11	1	11	1	The globe map appears to be an equal area projection although the shape of Africa seems shortened. Propose that the equal-earth map be used. In addition since oceans is an important component of the report, suggest to consider including the use of a Pacific Ocean centric map. The purpose is to also inform, visually, of the paucity of data available for certain geographic areas which may be most impacted. [Zelina Ibrahim, Malaysia]	the map is consistent with the preferred map projection used by the IPCC
12127	6	11	1	16	1	Figure 6.2 and Table 6.2 are related with each other. In Figure 6.2, there is extreme rainfall over East China, however in Table 6.2 there is super cold surge over East China. They do not match with each other. [Jianqi Sun, China]	thank you. This has been corrected

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
12913	6	11	1	16	1	Figure 6.2/Table 6.2: The intention of these two items is not clear to us. The table in Coumou and Rahmstorf listed meteorological record events that were unprecedented in very long time series as evidence supporting an increase in extreme weather, as predicted under climate change. Higher frequency of record-breaking meteorological events indicate a (drastic) change in underlying trends which can not yet be detected by conventional statistical analysis because the events in question are rare. However in this table, the authors seem to have compiled a vast list of recent extreme (impact) events (rather than unprecedented meteorological/climate events), with some bearing a reference to long-term statistics and others not. For example, "the world's deadliest storm" is extremely tragic but not a category that supports a link to anthropogenic forcing. Is this compilation intended to indicate a trend over time towards more/more intense extreme events, or to give an overview about the ocean-related events for which attribution exercises have been performed? Please clarify, and add text contextualizing both items. In Figure 6.2, it may be helpful to indicate whether a link to anthropogenic forcing was found, or not. Also, please change the order of the columns in table 6.2 so that the attribution is placed next to the hazard, as none of the studies listed are impact attribution studies. The impacts listed are not comprehensive and do not consider underlying trends or the role of specific circumstances of vulnerability and/or exposure. For a discussion on the difference between extreme weather events and extreme impact events and their attribution, you may wish to revisit AR5WGII Chapter 18 (Cramer et al., 2014, Section 18.4.3 and Table 18.3). Please also revise the column titles to be more specific. [Government of Germany, Germany]	the table is intended to highlight extreme events for which event attribution finds a link to climate change. We have reversed columns so that attribution is placed next to the hazard
31437	6	11	3	0		The key mixes extreme hazards and impacts, maybe separate into two key boxes, or decide which is to be communicated in the diagram [Hans-Otto Poertner and WGII TSU, Germany]	it has been decided to include to included extreme hazards rather than impacts so icons for coral bleaching and mangrove dieback have been removed
31439	6	11	3	0		Key: coral bleaching events are due to anomalous temperature events so this is an impact not an extreme [Hans-Otto Poertner and WGII TSU, Germany]	changed icons to represent the extreme not the impact
31441	6	11	3	0		key: Mangrove dieback this was driven by an intersection of extreme temp, drought and low sea level thus this is a compound impact [Hans-Otto Poertner and WGII TSU, Germany]	the purpose of listing this event is that it has been linked to extreme temperatures and drought
31741	6	11	6	0		Table 6.2 This table could be improved by enriching the quantitative approach to the concept of " Record Breaking", making clear what is the attribute, when was the previous record, and which is the current value. This will give clear credibility in terms of records - because for example, the "severely cold 2013 winter" in the UK in 2013, seems just to be a cold winter - what is the record here? was it the coldest in x years? The corresponding attribution column here mentions spring, not winter. [Hans-Otto Poertner and WGII TSU, Germany]	the purpose of the table was to illustrate how extreme events are being increasingly found to have links to climate change. It is acknowledged that many events are not 'record-breaking' and so this has been removed as well as the link to Coumou and Rahmstorf 2012 since this approach is not the same as used by Coumou and Rahmstorf
3941	6	11	6	15	0	Table 6.2: Column 3 refers to "severely cold 2013 WINTER" whereas column 5 refers to "odds of an extremely cold SPRING". Also, there is another paper by Christidis et al. that specifically focuses on this event ("The effect of anthropogenic climate change on the cold spring of 2013 in the United Kingdom"). Column 4 for this event may be completed with several impacts (e.g. Atlantic puffin wreck linked to cold temperatures and strong winds (Harris, M.P. & Elkins, N. 2013. An unprecedented wreck of Puffins in eastern Scotland in March and April 2013. Scot. Birds 32: 157–159.), damage to energy infrastructure, and sheep deaths). [Michaela Dolk, United States of America]	this event has been revised to an extreme rainfall event and the additional references added



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
29129	6	11	6	15	70	This is an enormously helpful compilation of attribution research on extreme events. As a simple compilation, given expanding research covering events also in 2018, if "allowed" would recommend that later research (eg despite missing the literature cut-off date in 2018) be added prior to SROCC finalization and publication. [Pam Pearson, Sweden]	Additional literature has been added from newly released BAMS Explaining extreme events of 2017
31443	6	12	0	0		Column 4: Specify "Brisbane river catchment flooding", the flood in Brisbane city was a different event to the flash floods of Toowoomba and the Lockyer valley [Hans-Otto Poertner and WGII TSU, Germany]	this change has been made
31445	6	12	0	0		Column 4, Western Australia: Suggested citations for this: Wernberg T, Smale, DA, Tuya F, Thomsen MS, Langlois TJ, de Bettignies T, Bennett S, Rousseaux CS (2013) An extreme climatic event alters marine ecosystem structure in a global biodiversity hotspot, Nature Climate Change, 3: 78-82.  Wernberg T, Bennett S, Babcock RC, de Bettignies T, Cure K, Depczynski M, Dufois F, Fromont J, Fulton CJ, Hovey RK, Harvey ES, Holmes TH, Kendrick GA, Radford B, Santana-Garcon J, Saunders BJ, Smale DA, Thomsen MS, Tuckett CA, Tuya F, Vanderklift MA, Wilson SK (2016) Climate driven regime shift of a temperate marine ecosystem. Science, 353(6295): 169-172. [Hans-Otto Poertner and WGII TSU, Germany]	these references have been added
31447	6	12	0	0		Column 4 2012 Arctic: Are the ecological and social impacts of the 2012 sea ice minimum addressed in Chp 3? if so, please add here, if not please liaise with chp 3 to address [Hans-Otto Poertner and WGII TSU, Germany]	Have checked chapter 3 and added a reference on algae plus a cross reference to chapter 3
8163	6	12	0	0		Row 4, column 4: replace commas with semi-colons for clarity [Nina Hunter, South Africa]	done
8165	6	12	0	0		Row 7, column 5: "exceptional 2012 sea-ice loss" could be moved to the empty cell in column 4 [Nina Hunter, South Africa]	have now added an ecological impact to column 4
2715	6	12	1	12	1	With respect to Figure 6.2, in addition to the extreme rainfall of eastern Australia and Golden Bay, New Zealand, the 2010 Monsoon flood of Pakistan, the 2011 Tropical storm Washi of Philippines are also good or better examples of such extreme climate events? Also, is the Global SST during 2014 still the highest over observational records without the influence of a strong El Niño? [Thian Yew Gan, Canada]	No action suggested
31449	6	13	0	0		Column 3 2013 UK: winter of 2009 and 2010 according to paper, not 2013 [Hans-Otto Poertner and WGII TSU, Germany]	This event has been corrected to the 2013 extreme rainfall event and references corrected
31451	6	13	0	0		Column 4 2013 UK: Any impacts to discuss otherwise do not include this event [Hans-Otto Poertner and WGII TSU, Germany]	This event has been corrected to the 2013 extreme rainfall event and impacts discussed
31453	6	13	0	0		Column 4 2014 Pacific Ocean: Impacts are missing [Hans-Otto Poertner and WGII TSU, Germany]	impacts have been added
31455	6	13	0	0		Column 4 2014 Hawaii: Impacts are missing [Hans-Otto Poertner and WGII TSU, Germany]	Impacts on corals have been added
31457	6	13	0	0		Column 4 2014 Arabian Sea: Ecosystem and/or human impacts are missing [Hans-Otto Poertner and WGII TSU, Germany]	although no significant ecosystem and/or human impacts were found, the attribution to climate change of post-monsoon cyclones is important to include
8167	6	13	0	0		Impact and cost of the extreme event missing in empty cells in column 4 [Nina Hunter, South Africa]	these gaps have been addressed
8169	6	13	0	0		Row 3, column 5: I would have thought odds of an extremely cold spring would have been increased if the winter was severely cold? [Nina Hunter, South Africa]	this entry has been revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16987	6	13	0	13		For 2013 Western North Pacific, typhoon Haiyan, Takayabu et al. (2015, Environmental Research Letters) should be added in the table. This investigated the anthropogenic effect on the intensification of Haiyan by the even-attribution approach. [Masaki Satoh, Japan]	Thank you. This has been added
31459	6	14	0	0		Column 3 2015 North America: Add the severe hazard [Hans-Otto Poertner and WGII TSU, Germany]	severe hazard has been added
31461	6	14	0	0		Column 4 2015 Arctic: Add ecosystem and / or human impacts, check with Chp 3 [Hans-Otto Poertner and WGII TSU, Germany]	have added general impacts that are discussed in chapter 3 though no mention specifically of impacts from the 2015 event were found
8173	6	14	0	0		Row 1, column 4: change "to" to "in" [Nina Hunter, South Africa]	this change has been made
8175	6	14	0	0		Row 1, column 5: change "enlarge" to "enlarged" [Nina Hunter, South Africa]	have changed wording to not include enlarge
8177	6	14	0	0		Row 5, column 3: a "Category 5" what? [Nina Hunter, South Africa]	TC has been added
8179	6	14	0	0		Row 5, column 5: "extremely record SSTs" - meaning not clear [Nina Hunter, South Africa]	extremely has been changed to extreme
8181	6	14	0	0		Row 6, column 4: change comma after "respectively" to full stop [Nina Hunter, South Africa]	done
31463	6	15	0	0		Column 1 north America: the hazard is a compound event - extreme heat, drought and lower sea levels, the mangrove dieoff is the impact [Hans-Otto Poertner and WGII TSU, Germany]	a compound event icon was created for this event
31465	6	15	0	0		Column 4 2016 Arctic: Add ecological and/or social impact [Hans-Otto Poertner and WGII TSU, Germany]	impacts have been added
31467	6	15	0	0		Column 4 2016 Alaska: Be more specific, this had ecological and economic impacts [Hans-Otto Poertner and WGII TSU, Germany]	more information on the impacts have been added
31469	6	15	0	0		Column 4 2016 Antarctic: Add ecological and/or social impact [Hans-Otto Poertner and WGII TSU, Germany]	more information on the impacts have been added
31471	6	15	0	0		Column 1 2016 GBR: the anomalous heat is the hazard, coral bleaching is the impact [Hans-Otto Poertner and WGII TSU, Germany]	the Figure icons have been revised. In particular coral bleaching icon was replaced by a MHW icon and mangrove dieback icon was replaced by a new icon representing a compound event. Several new events were added including those from Box 6.1
30099	6	15	0	15	0	An ocean influence on the 2016 Antarctic sea ice record and its sustained decline is discussed also in Meehl et al Nature Communications 2019 [Julie Arblaster, Australia]	This reference has been added
30101	6	15	0	15	0	I'm surprised the Antarctic sea ice changes in 2016 are not discussed in the text. If not in this chapter then add pointers to other chapters e.g. 3.2.1.1. [Julie Arblaster, Australia]	reference to chapter 3 has been added
8183	6	15	0	0		Row 1, column 4: remove "loss of" [Nina Hunter, South Africa]	Done
8185	6	15	0	0		Row 6, column 5: I would think the cold surge would be weaker with no anthropogenic warming? [Nina Hunter, South Africa]	these studies showed that the magnitude of such events decreased due to anthropogenic influence.

SROCC Second Order Draft Government and Expert Review Comments - Chapter 6							
Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25849	6	15	0	15		Concerning Ophelia (2017), the attribution issue needs some revision. Storm Ophelia is not « in line with projection of stronger cyclones in Europe » but « in line with an increase of cyclones of tropical origin hitting european coast in early autumn with hurricane force winds» in agreement with the cited paper of Haarsma et al (2013). It is perhaps to be summarized but present summary is misleading. [Serge PLANTON, France]	this suggested change has been incorporated
23405	6	16	1	16	12	There are many published paper about TC poleward. I am not sure if it is enough to support the conclusion in case only one paper such as Kossin et al. (2016) is cited here. [Rongshuo Cai, China]	Have added Moon et al, 2015 and Kossin et a. 2014 to Kossin et al 2016
3047	6	16	1	20	49	These two sections adress points which are also discussed in chapter 4 (section 4.2.3.4). There might be some cross-referencing between the two chapters to help the reader and to explain how the two sections in chapter 4 and 6 complement each others. [Goneri Le Cozannet, France]	the relevant section in chapter 4 is now cross-referenced
22265	6	16	5	16	5	Paleoclimate evidence is missing from the discussion in this section. There is evidence (at least) for Australia and the Americas that gives a multi-century perspective to tropical cyclone/hurricane occurrence. [Abram Nerilie, Australia]	some paleo information has been added
8187	6	16	7	0		References not cited correctly. Should be: (Bindoff et al. 2013 and Knutson et al. 2010) [Nina Hunter, South Africa]	references have been fixed up
22261	6	16	7	16	7	It would be helpful to start this section with a summary sentence on what AR5 concluded regarding tropical cyclones. [Abram Nerilie, Australia]	The summary statement of the AR5 findings has been moved to the start of this section
10239	6	16	9	16	12	Suggest also including the study by Kossin (2018) regarding the global slowdown in translation speeds of TCs, especially over land regions of Australia, the western North Pacific, and Atlantic. Ref : Kossin, J.P., 2018: A global slowdown of tropical-cyclone translation speed. Nature, 558, 104. [SAI MING LEE, China]	this study is now included
10237	6	16	12	16	12	For consistency, please replace "western north Pacific" by "western North Pacific" to align with the rest of the text. [SAI MING LEE, China]	this change has been made
8189	6	16	17	16	18	Suggest rephrasing for clarity: Emanuel's (2013) finding of a projected increase in global TC frequency was noteworthy, since it was at variance with .... [Nina Hunter, South Africa]	this sentence has been rephrased
13189	6	16	17	16	19	Is is possible to highlight in the text why the finds from Emanuel (2013) on projections on global TC frequency differs from findings of other researchers mentioned in lines 14 to 17? [GEOFFREY EVANS OWINO OGUTU, Kenya]	a brief mention of possible reasons is now given
1757	6	16	21	16	24	Sentence seems to contradict itself, talking first about increased mixing of cooler waters to the surface, and then increased stratification - aren't these two things contradictory? [Mark Payne, Denmark]	the sentence has been rephrased
15849	6	16	21	16	24	Sentence seems to contradict itself, talking first about increased mixing of cooler waters to the surface, and then increased stratification - aren't these two things contradictory? [EUCE, Belgium]	the sentence has been rephrased
21203	6	16	21	16	24	This paragraph is trying to connect two contrasting ideas. Consider to separate the ideas, probably explaining the effect of increased mixing of cooler subsurface water after describing greater thermal stratification. [APECS Group Review, Germany]	the sentence has been rephrased
23407	6	16	21	16	26	"Although..... Tuleya et al., 2016)" in this paragraph actually repeat the text and result of the Chapter 4 (Page 53, Line20-25). I would suggest to remove that or directly cite the results of Chapter 4 to avoid the repeat content. [Rongshuo Cai, China]	for completeness, we retain this text although it has been rephrased somewhat.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23411	6	16	21	16	26	The text is the same as the chapter 4. [Rongshuo Cai, China]	as above
22263	6	16	21	16	29	The ocean mixing caused by cyclones may also offset some climate change impacts (e.g. 2016 bleaching of GBR did not affect southern parts of the reef as a tropical cyclone passed over this area causing the ocean to cool along the cyclone track). [Abram Nerilie, Australia]	This point has been made more clearly in the revised text that cites Emanuel 2015 Huang et al 2015 and Tuleya et al 2016.
9853	6	16	26	16	28	Is "reduced" the right word for salinity ? A better wording would perhaps be "low" or "lower" surface salinity (with reference to the "barrier layer" to a deep/deeper mixing layer caused by low salinities in regions of intense precipitations or river runoff). [Government of France, France]	Reduced is appropriate in this context. The sentence has been rephrased slightly to make the points clearer
8191	6	16	49	0		Change "sign" to "significance"? [Nina Hunter, South Africa]	We mean sign as in TCs can increase or decrease by up to 10%
21205	6	16	49	16	49	Suggestion: Add " + " to 10%, this will help to explain the following. [APECS Group Review, Germany]	This has been clarified to mean that changes up to ±10% can occur
23293	6	16	52	17	27	ES statement 1 not fully consistent with conclusion of 6.3.3.1 on detection and attribution. To consider very carefully to avoid key findings of SROCC challenged by AR6 WGI report in 2 years. [Valerie Masson-Delmotte, France]	the ES statement has been revised to reflect the content of the TC section
8193	6	16	53	16	54	"Aerosol" has been defined in the glossary but not "aerosol forcing" - please could you define briefly in parentheses [Nina Hunter, South Africa]	Aerosol forcing now appears in parenthesis to clarify what is being referred to
10079	6	16	53	16	54	There is a bit of confusion here. The statement that reads "There is a medium confidence reduction in aerosol forcing over the North Atlantic" is not based on Bindorff et al., 2013 but in the papers by Villarini, G., and G. A. Vecchi. For instance, the work published in 2012 (Twenty-first-century projections of North Atlantic tropical storms from CMIP5 models. Nat. Climate Change, 2, 604–607) refers to the changes in the observed reduction (increase) in North Atlantic Surface Temperature frequency in the 1970–1980s (1990–2000s) due to radiative forcing from changes in anthropogenic aerosols. In other words, aerosols are not direct forcing of North Atlantic TC, because they alter the radiative forcing, then the sea surface temperature, and therefore, the cyclogenesis capability of the ocean. [Elsa Arellano-Torres, Mexico]	the paragraph dealing with aerosol forcing has been reworded to make clearer
23409	6	17	1	17	2	As we know, a level of confidence is expressed using five qualifiers: "very low," "low," "medium," "high," and "very high." I am wondering if the "low-to-medium confidence" is consistent with that? [Rongshuo Cai, China]	the contributing author has used these statements as they are consistent with an article that is about to be published in BAMS by the WMO expert team on tropical cyclones
8195	6	17	9	0		Insert "iv)" before "intense" [Nina Hunter, South Africa]	done
10241	6	17	19	17	20	Please note that the statement "sea level rise over the coming century will lead to higher storm surge levels for the TCs that do occur" may not be entirely correct as storm surge normally refers to the increase in water level above the normal astronomical tide level due to tropical cyclones. The fact is that future sea level rise will certainly exacerbate the impacts of storm surge induced by tropical cyclones and related risk of extreme water levels. Please consider rephrasing this statement. [SAI MING LEE, China]	this statement has been rephrased
5269	6	17	19	17	21	The idea in this part isn't clear - 1) sea level rise over the coming century will lead to higher storm surge levels for the TCs that do occur, assuming all other factors are unchanged (high confidence). For example which studies are realized for the next century, when almost all are related to XXI century [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	the intended meaning was towards the end of this century. The statement has now been rephrased

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22267	6	17	19	17	21	With the current wording of point 1, I would have expected that the assessment outcome would give a higher confidence level than this. [Abram Nerilie, Australia]	the confidence statement has been revised
5267	6	17	19	17	27	This paragraph don't have references or parts in the Chapter where maybe seek. [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	The paragraph in question was a summary of the preceding paragraphs, which cite the evidence
10245	6	17	19	17	27	Suggest including the following statement : "Moreover, the plausible increase in TC induced extreme wind waves due to the projected increase in TC intensity may further aggravate the impacts of storm surge and sea level rise on coastal structures (Timmermans et al., 2017, 2018)." Ref : 1. Timmermans, B., D. Stone, M. Wehner, and H. Krishnan, 2017: Impact of tropical cyclones on modeled extreme wind-wave climate. Geophys. Res. Lett., 44, 1393–1401, doi:10.1002/2016GL071681 2. Timmermans, B., C.M. Patricola, and M.F. Wehner, 2018: Simulation and analysis of hurricane-driven extreme wave climate under two ocean warming scenarios. Oceanography, 31, DOI: 10.5670/oceanog.2018.218. [SAI MING LEE, China]	we have included the first reference
8197	6	17	21	17	25	Sentence 1 should not end with a full stop if it is following on colon. Likewise sentence 2 should not start with a capital, and the same for end of sentence 2 and start of sentence 3. [Nina Hunter, South Africa]	the punctuation has been corrected
10243	6	17	21	17	25	Similar to the projected intensity change mentioned in 2), it is suggested also including the projected range of increase in TC rainfall rates for a 2oC global warming scenario. [SAI MING LEE, China]	the literature did not provide such information range on the projections
23413	6	17	21	17	27	I am wondering if "3)There is low confidence in how global TC frequency or the global frequency of very intense (Category 4–5) storms will change" is consistent with "3) There is medium confidence that the proportion of TCs that reach Category 4–5 levels will increase"? How could we understand the difference between "the frequency will change (low confidence)" and "the proportion will increase (medium confidence)"? [Rongshuo Cai, China]	the statements have been revised
12915	6	17	22	17	23	It is not clear from the text of section 6.3.1.1 which warming scenarios are being considered. Please specify whether the statements are valid across RCPs, and add information on how RCP8.5 could increase TC intensity. [Government of Germany, Germany]	The results reported relate to studies that investigate a 2C warming
12917	6	17	25	17	25	Please add reference and explanation why you have low confidence here, and specify whether this is true under all warming scenarios, especially under RCP8.5 conditions. [Government of Germany, Germany]	The summary statement for TC's has been revised. Lower confidence in some projections is due to the lack of robust detection in observations despite high agreement in projected changes.
12141	6	17	25	17	27	Few models can be provided here briefly for better understanding. [Narendra Dalei, India]	this is a brief summary statement. The paragraph where the future projections are discussed appears earlier in this section

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
27203	6	17	29	18	6	Chapter 6 looks to be in good shape. However, I thought that the topic of Arctic amplification and its potential impact on the jet stream/mid-latitude storms might be considered in Sec 6.3.3.2. Evaluations of atmospheric reanalyses provide some evidence that the Northern Hemisphere jet stream has slowed in recent years and exhibits persistent meanders with a greater meridional extent, potentially as a result of Arctic amplification (Francis & Vavrus 2012, 2015). However, the causal mechanism and extent of meandering remain a topic of significant debate (Screen&Simmonds 2013, Coumou et al. 2015, Kretschmer et al. 2016). A persistent meandering atmospheric state favors weather extremes (Francis&Skific 2015, Roethlisberger et al. 2016, Mann et al. 2017) and thus has the potential to generate significant impacts over mid-latitude land areas e.g. Balkan flooding (Stadtherr et al., 2016) ultimately as a result of cryospheric changes. It would be good to see some of this discussed / assessed particularly as it is an area of conflicting viewpoints. [Sion Josey, United Kingdom (of Great Britain and Northern Ireland)]	thank you for your suggestions, this literature has been reviewed and incorporated
4225	6	17	29	18	8	Probability of occurrence Extratropical Cyclones and Blocking will increased in different regions such as Iran and middle east and there are some evidences such as heavy snow in Coastal areas of the Caspian Sea. [Behzad Layeghi, Iran]	recent peer reviewed literature on this topic could not be found to address this point
5505	6	17	29	18	8	Probability of occurrence Extratropical Cyclones and Blocking will increased in different regions such as Iran and middle east and there are some evidences such as heavy snow in Coastal areas of the Caspian Sea. [rashidian leila, Iran]	see above
5565	6	17	29	18	8	Probability of occurrence Extratropical Cyclones and Blocking will increased in different regions such as Iran and middle east and there are some evidences such as heavy snow in Coastal areas of the Caspian Sea. [Government of Iran, Iran]	see above
22275	6	17	29	18	8	Low confidence is given to projected future changes in blocking, but I can't see any assessment with confidence language for observed changes in extratropical cyclones or blocking, or for observed changes in blocking. [Abram Nerilie, Australia]	the confidence statement has been revised
22269	6	17	34	17	36	Are the ozone effects only relevant for the SH and the summer season? In which case it should follow that it isn't challenging to project ETCs in the Northern Hemisphere and in the Southern Hemisphere winter where the opposing influence of ozone isn't a factor. [Abram Nerilie, Australia]	The sentence has been simplified to discuss just the CO2 effects to avoid this hemispheric difference
12129	6	17	52	18	8	There are some researches on the blocking activity under the global warming background. There is close relationship between the Ural Blocking and Arctic sea ice (e.g., Ural Blocking as an Amplifier of the Arctic Sea Ice Decline in Winter, <a href="https://doi.org/10.1175/JCLI-D-16-0548.1">https://doi.org/10.1175/JCLI-D-16-0548.1</a> ). I suggest to review this study here. [Jianqi Sun, China]	This reference has been added
22271	6	17	53	17	53	Would probably be helpful to the reader to put "(high pressure)" after anticyclone. [Abram Nerilie, Australia]	Done
22273	6	17	56	17	57	"enhance particulate matter concentrations" in the atmosphere?, in the oceans?. And should "photochemically-induced surface ozone during spring and summer" be "ozone depletion during spring and summer? [Abram Nerilie, Australia]	this detail has been removed in an attempt to shorten the section overall

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
17553	6	18	2	18	8	Declining sea ice and added warming in the Arctic also impacts mid-latitude weather patterns. Francis J. A. & Vavrus S. J. (2015) Evidence for a wavier jet stream in response to rapid Arctic warming, ENVTL. RESEARCH LETTERS 10(014005):1–12; Francis J. A. & Vavrus S. J. (2012) Evidence linking Arctic amplification to extreme weather in mid-latitudes, GEOPHYSICAL RESEARCH LETTERS 39(L06801):1–6; Screen J. A. & Simmonds I. (2013) Exploring links between Arctic amplification and mid-latitude weather, GEOPHYSICAL RESEARCH LETTERS 40:959–964; Cohen J., et al. (2018) Warm Arctic episodes linked with increased frequency of extreme winter weather in the United States, NATURE COMMUNICATIONS 9(869):1–12. [Kristin Campbell, United States of America]	The discussion has been expanded to include some of these references
17667	6	18	2	18	8	Declining sea ice and added warming in the Arctic also impacts mid-latitude weather patterns. Francis J. A. & Vavrus S. J. (2015) Evidence for a wavier jet stream in response to rapid Arctic warming, ENVTL. RESEARCH LETTERS 10(014005):1–12; Francis J. A. & Vavrus S. J. (2012) Evidence linking Arctic amplification to extreme weather in mid-latitudes, GEOPHYSICAL RESEARCH LETTERS 39(L06801):1–6; Screen J. A. & Simmonds I. (2013) Exploring links between Arctic amplification and mid-latitude weather, GEOPHYSICAL RESEARCH LETTERS 40:959–964; Cohen J., et al. (2018) Warm Arctic episodes linked with increased frequency of extreme winter weather in the United States, NATURE COMMUNICATIONS 9(869):1–12. [Durwood Zaelke, United States of America]	The discussion has been expanded to include some of these references
22283	6	18	10	19	18	An overall assessment with confidence language is needed still for section 6.3.3.3 [Abram Nerilie, Australia]	A summary section with confidence language has been added
12131	6	18	12	19	18	According to the city flood risk caused by the sea level rise, I suggest to review this study here (multi-dimensional integrated approach to assess flood risks on a coastal city, induced by sea-level rise and storm tides, <a href="http://iopscience.iop.org/article/10.1088/1748-9326/11/1/014001">http://iopscience.iop.org/article/10.1088/1748-9326/11/1/014001</a> ) [Jianqi Sun, China]	This study examines the inundation risks across ecological, physical and socio-economic dimensions rather than establishing new insights into future changes in waves and extreme sea levels and so may be relevant for section 6.2.3
4603	6	18	15	18	17	Is that based on observations? Or models? Or both? [The UBern Team Group Review, Switzerland]	It is based on models. This has been clarified
22277	6	18	30	18	46	"Sea Surface Temperature", "Sea Level Rise", "Mean High Water", shouldn't be capitalised. [Abram Nerilie, Australia]	Done
8199	6	18	34	0		Suggest remove comma after "0.5m" [Nina Hunter, South Africa]	Done
22279	6	18	34	18	35	"SLR scenarios from 0.5 m, to 10 m Mean High Water changes exceed ±10% of the imposed SLR at around 10% of coastal cities". Comma after 0.5 m is not needed. Also seems that +/- should only be + as you are talking about exceeding an imposed SLR. Better phrasing would be "...exceed the imposed SLR by 10% or more at around 10% of ..." [Abram Nerilie, Australia]	Done
14627	6	18	36	18	37	The following sentence is not clear and should be rephrased (see suggested changes): "Abrupt changes in impacts therefore are not only determined by changes in cyclone hazard, but also by the sensitivity or tipping points that are crossed. For instance [DEL: in terms of ] flooding [DEL: for instance, that] can be driven by sea-level rise but also by changes in local exposure". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	This comment relates to section 6.3.3 Impacts

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22281	6	18	37	18	40	Are these extreme sea level number consistent with the new assessment of sea level rise in chapter 4, or are they based on AR5 SLR projections. Is there any adjustment needed for consistency with findings in chapter 4? [Abram Nerilie, Australia]	The ranges given appear consistent with the changes for 100-year events in chapter 4 Figure4.9
12017	6	18	39	0		This text should be by Vousdoukas et al 2018 (Nature Communications), the NCLIM paper is cited correctly in page 45, line 56 [Michail Vousdoukas, Italy]	thank you for picking this up. The correct reference is added
34045	6	18	45	18	46	Should specify anticipated resolution that will be needed. [Government of United States of America, United States of America]	model resolution has been added
10081	6	19	17	19	18	For clarification, it is important to mention the % chance of occurrence or the probability of occurrence in the following sentence. "Consequently, flood heigh return periods that were ~500y during the preindustrial (0.2% chance, or 1 in 500 probability of occurrence in a given year) have fallen to ~25y at present (4% chance, or 1 in 25 probability of occurrence in a given year); but are projected to fall to ~5y within the next three decades (20% chance, or 1 in 5 probability of occurrence in a given year)." [Elsa Arellano-Torres, Mexico]	This detail has been added as suggested
10083	6	19	20	19	20	This subtitle is confusing. Why not to to call it "Western Boundry Currents," or "Longshore transport effects"? [Elsa Arellano-Torres, Mexico]	Have changed the section title to 'Multiple Hazards'. This section has also been moved to section 6.8 where compound risk and cascading impacts is also discussed
4227	6	19	20	20	5	An increased ocean water temperature can lead to increase heavy rains In adjacent areas. Such as increasing water temperature of the North Indian Ocean and oman sea that it may be lead to heavy rains in the central parts of Iran. [Behzad Layeghi, Iran]	we were unable to find literature discussing this linkage
5507	6	19	20	20	5	An increased ocean water temperature can lead to increase heavy rains In adjacent areas. Such as increasing water temperature of the North Indian Ocean and oman sea that it may be lead to heavy rains in the central parts of Iran. [rashidian leila, Iran]	we were unable to find literature discussing this linkage
5567	6	19	20	20	5	An increased ocean water temperature can lead to increase heavy rains In adjacent areas. Such as increasing water temperature of the North Indian Ocean and oman sea that it may be lead to heavy rains in the central parts of Iran. [Government of Iran, Iran]	we were unable to find literature discussing this linkage
22285	6	19	22	19	43	Western Boundary current regions should be explained. Non-experts will probably not know what parts of the world this refers to. [Abram Nerilie, Australia]	the sentence has been reorganised to make the connection between WBC and the named currents we are referring to clearer
9855	6	19	33	19	35	Here there should be also an influence of WBCs waters warming and consequent impact in the steric sea-level. [Government of France, France]	the link to enhanced SLR is discussed
22287	6	19	36	19	43	The "FI" acronym isn't needed. Only used once in the pragraph so it is much clearer for readers to simply use the full words. As a more general point, there are many sections of text that are difficult to read because of the heavy use of acronyms. Please avoid using them unless they really are commonly used and needed. [Abram Nerilie, Australia]	FI removed
8201	6	19	42	0		Change "demonstrates" to "demonstrate" [Nina Hunter, South Africa]	Done



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
3045	6	19	53	19	53	I agree that the progresses in shoreline change projections since one decade or so justify a paragraph in this section, but I wonder why the term "robust" is used here: 'robust' implies here that the future "true" shoreline positions will be included in the model uncertainties. I don't think that we guarantee this yet. One may argue that two alternatives approaches would be equally valuable: (1) the use of the Bruun rule (which has not been invalidated yet); (2) the use of a different dune erosion and reconstruction module within the PCR model. Both approaches would lead to very different estimates of future shoreline position, potentially outside the distribution of a single PCR framework. Overall, I would suggest to emphasize that there are still structural uncertainties in current shoreline change projections. [Goneri Le Cozannet, France]	the term robust has been removed
34047	6	19	53	19	53	A word appears missing in the sentence, confusing clarity of thought. This sentence can be combined with the previous to improve readability -- e.g., "The methodology generates thousands of multi-variate time series of waves and storm surges to probabilistically reconstruct future shoreline evolution, thus providing estimates of long-term and extreme coastline change." [Government of United States of America, United States of America]	sentence joined with previous using ', which'
8203	6	19	53	19	54	Suggest change to "This enables robust estimates of extreme recessions and long-term coastline change to be obtained." [Nina Hunter, South Africa]	Change has been made
31473	6	20	7	0		very little or no use of confidence language in these sections [Hans-Otto Poertner and WGII TSU, Germany]	Because of the variety of impacts, we found it difficult to make a generic confidence assessment
22289	6	20	7	20	49	What is the take away assessment (with confidence language) for impacts (observed and future) associated with cyclones? [Abram Nerilie, Australia]	Because of the variety of impacts, we found it difficult to make a generic confidence assessment
5123	6	20	7	20	7	Besides fish, it might also be useful to look at impacts on other coastal ecosystems [Debra Roberts and Durban Team, South Africa]	reject, coral reefs are mentioned and mangrove
8205	6	20	10	20	11	"has been a signal from anthropogenic climate change" - could this be stated better? It is not clear what is meant [Nina Hunter, South Africa]	Accepted, text revised
10249	6	20	11	20	13	Please consider including the following references related to the track shift and changes of TC exposure : 1. Zhao, H.K. and Liguang Wu, 2014 : Inter-decadal shift of the prevailing tropical cyclone tracks over the western North Pacific and its mechanism study, Meteorol. Atmos. Phys. 125, 89-101. 2. Park, D.S.R., C.H. Ho, and J.H. Kim, 2014 : Growing threat of intense tropical cyclones to East Asia over the period 1977-2010, Environmental Research Letter, 9, 014008. 3. Li, C.Y., W. Zhou, C.M. Shun and T.C. Lee, 2017 : Change in Destructiveness of Landfalling Tropical Cyclones over China in Recent Decades, Journal of Climate, 30, 3367-3379, <a href="http://dx.doi.org/10.1175/JCLI-D-16-0258.1">http://dx.doi.org/10.1175/JCLI-D-16-0258.1</a> 4. Kossin, J. P., K. A. Emanuel, and S. J. Camargo, 2016: Past and projected changes in western North Pacific tropical cyclone exposure. Journal of Climate, 29, 5725-5739. [SAI MING LEE, China]	Some of these references have been cited in section 6.3.1 rather than here
10247	6	20	13	20	13	Please replace "TC Hayan" by "Super Typhoon Haiyan" [SAI MING LEE, China]	done

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14629	6	20	17	20	19	The following sentence is too long, not very clear and should be re-phrased: The lack of coordination is seen among different government agencies, such as in the US between the Federal Emergency Management Agency and Housing and Urban Development (Olshansky and Johnson, 2014); between government and international and national nongovernmental organizations offering response services (Santiago et al., 2016); between the different non-governmental organizations where the institutional capacity of the government is weaker; and among the government and self-organized volunteers that use more flexible bottom-up tools such as participatory mapping and social media (Wridt et al., 2016). [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	done
22573	6	20	20	20	22	Suggest including additional text to recognise that damaging waves from severe cyclones have caused significant damage to coral reef habitats, resulting in loss of coral cover.  See: De'ath, G., Fabricius, K.E., Sweatman, H. and Puotinen, M. 2012, The 27-year decline of coral cover on the Great Barrier Reef and its causes, Proceedings of the National Academy of Sciences 109(44): 17995-17999. [Government of Australia, Australia]	inserted the word 'cover' next to coral reef
12919	6	20	21	20	24	The consequences of the statement remain unclear (whether they are positive or negative). Changes are not bad in any case. Please be more specific. [Government of Germany, Germany]	description of the specific ecological loss and damage discussed in the lines you mentioned.
12921	6	20	29	20	30	Please consider to lift this crucially relevant information to the ES and to the SPM. [Government of Germany, Germany]	reject, this is standard knowledge. More relevant are estimates of how losses and impacts have changed
8207	6	20	35	0		Change "impact" to plural [Nina Hunter, South Africa]	impact here is collective, so singular should be ok.
5121	6	20	35	20	39	Are there regional differences? [Debra Roberts and Durban Team, South Africa]	Accepted, some very poor countries don't show a decline. We will add this.
12923	6	20	38	20	39	Please consider to lift this highly relevant information to the ES and to the SPM. [Government of Germany, Germany]	Accepted - text included in ES
8209	6	20	46	0		Change "shows" to singular [Nina Hunter, South Africa]	done
22291	6	20	51	21	45	What role does the financial industry (insurance, home loans) play in rebuild or retreat decision making? [Abram Nerilie, Australia]	Accepted - Insurance would raise premiums, and disincentivise rebuilding, if probability of losses are too high. This is a generic function of insurance, that we include now here.
22293	6	20	51	21	45	Similarly, it seems like something should be said here also about the cultural heritage/indigenous aspects of rebuild or retreat decision making. [Abram Nerilie, Australia]	Accepted, we add now that retreat may imply important losses for cultural heritag and indigenous qualities.
22165	6	20	53	21	45	"Risk Management and Adaptation subsection on Cyclones is too generic with limited references and information. The section could be strengthened from experiences drawn from other countries like India and Southeast Asian countries where the cyclone response has strengthened over the years. The section may also provide approximate economic cost, technology and capacity-building/ skills required for risk management and adaption. It is important to note that though disaster risk management is primarily driven by the respective countries but sea level rise is a global climate change problem which requires global support." [NAYANIKA SINGH, India]	discussed in 6.9 governance section, also ch. 4

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25709	6	20	53	21	45	"Risk Management and Adaptation subsection on Cyclones has limited information on the global/ regional dimension of the problem as well as adaptive measures required for risk mitigation at the global level." [Government of India, India]	discussed in governance setion, 6.9
12925	6	20	55	20	56	Please consider to lift this crucially important information to the ES and to the SPM. [Government of Germany, Germany]	Rejected - It is incorrect statement and reflection from Needham et al. 2015. Text is revised
2717	6	21	7	21	15	What could be more effective early warning systems to implement in regions prone to such destructive storms, that will issue a clear warning of an imminent storm of destructive magnitude arriving shortly, in places such as New Orleans (hurricane Katrina) or the east coast of USA? [Thian Yew Gan, Canada]	Accepted - We have now added some text explaining that in such high risk places, evacaution needs to be complemented with measures for protection and improved self-reliance.
8211	6	21	14	0		Suggest make two sentences into one; insert comma after "Kulkarni" reference, replace "They contribute" to "and this contributes" [Nina Hunter, South Africa]	done
24851	6	21	15	21	16	These examples also show that it is necessary to create warning systems and evacuation plans for the high risk areas. [Government of Hungary, Hungary]	noted
10839	6	21	17	21	24	If possible to add some experiences of risk managment departments to overcome the problem of coordination in case of extrem events; for exemple the training and simulations of extrem events before it occurred. Also showing the difference between the two cases (with and without training or simulation before) in reducing the risk (number of victimes, score,...) [khadija kadibi, Morocco]	Accepted - We have added text and referenes to training and simulation. We are not aware of ex-post and ex ate studies after training and improved coordination, which would also be difficult to attribute, as many other factors play a role, related to the storm and exposed people.
14631	6	21	18	21	24	In the following sentence: "The lack of coordination is seen among different government agencies, such as in the US between the Federal Emergency Management Agency and Housing and Urban Development", Housing and urban Development should be quoted with its correct and full title, namely the"United States Department of Housing and Urban Development". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	As coordination was overly on disaster management and not coupled with ciimate change, we removed the coordination paragraph.
14633	6	21	19	21	20	In order to provide more clarity about the context, we suggest revising the following sentence as follows: "Buyout programs, a form of 'managed retreat' whereby government agencies pay people affected by extreme weather events to relocate to safer areas, gained traction in recent years as a potential solution to reduce exposure to changing storm surge and flood risk". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	done
14635	6	21	26	21	27	We suggest revising the following sentence as follows: "Seasonal SST predictions can also be used as early warning systems for multiple other ecosystems, as well as productive industries such as aquaculture, lobster, sardine, and tuna fisheries". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	this sentence does not correspond to the sentence you indicated us to correct.
8213	6	21	31	0		Suggest change "among" to "between" [Nina Hunter, South Africa]	done
8215	6	21	32	0		After "unpopular" suggest insert comma and then "as" [Nina Hunter, South Africa]	edited the phrase

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9239	6	21	39	21	45	And actions to change the dimensions of the hazard, through green (or nature-based solutions) and physical infrastructure. Urban and land-use plans should integrate DRR and CCA and CCM. the language hard-defence structures does not seem appropriate, the use of the term defence translates the idea of conflict between the human and the natural systems, instead of seeking sustainability. A more appropriate term could be physical infrastructure. In order to withstand disaster impact, resistance design is required in the first place, because resilience relates to risk more broadly. The adoption of hybrid systems (green and physical) works better in high density areas, while green infrastructure works better in lower population density areas. [Urbano Fra.Paleo, Spain]	Accepted - text revised.
11737	6	21	45	21	47	This paragraph leaves the reader hanging somewhat. Suggest that the literature on signals and triggers for warning and in-time decision making be added here to show that there are other ways of addressing the problems described. For example the following text and references could be added. " To address such problems anticipatory planning approaches are developing and increasingly being taken up that warn communities and enable shifts in strategies to be adopted before the worst losses occurring" Lawrence, J., et al., National guidance for adapting to coastal hazards and sea level rise: Anticipating change, when and how to change pathway. Environmental Science & Policy, 2018. 82( <a href="https://doi.org/10.1016/j.envsci.2018.01.012">https://doi.org/10.1016/j.envsci.2018.01.012</a> ): p. 100-107. Lawrence, J. and M. Haasnoot, What it took to catalyse uptake of dynamic adaptive pathways planning to address climate change uncertainty. Environmental Science & Policy, 2017. 68: p. 47-57. Bloemen, P., M. Van Der Steen, and Z. Van Der Wal, Designing a century ahead: climate change adaptation in the Dutch Delta. Policy and Society, 2018: p. 1-19. Barnett, J., et al., A local coastal adaptation pathway. Nature Climate Change, 2014. 4: p. 1103-1108. Lawrence J., R. Bell, and A. Stroombergen, A hybrid process to address uncertainty and changing climate risk in coastal areas using Dynamic Adaptive Pathways Planning, Multi-Criteria Decision Analysis & Real Options Analysis. Sustainability, 2019. Special Issue Policy Pathways for Sustainability(accepted in press). [Judy Lawrence, New Zealand]	Accpeted - text revised.
31475	6	21	48	0		This section needs some clarity, on difference/overlap between MHW and other metrics of temperature extremes eg DHW for coral bleaching [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - We now state upfront the differences between MHW and DHW metric.
31481	6	21	48	0		this section needs a clear definition of MHW as the term is used interchangeably with Degree Heating Weeks (Are all coral thermal stress events MHW? ) and other metrics of extreme temperature. Hobday et al 2016a define MHW as 'an anomalously warm event to be a MHW if it lasts for five or more days, with temperatures warmer than the 90th percentile based on a 30-year historical baseline period. ' Is this definition used in all MHW studies? if not please be specify [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - We now define MHW upfront and also relate it to the defintion of DHWs.
10085	6	21	48	21	48	The definition of "marine heatwave" by Hobday et al. (2016) is not entirely familiar to everyone and could be misinterpreted. It should be defined earlier in the text. For example, in the Executive Summary like "a prolonged anomalous warm water event" [Elsa Arellano-Torres, Mexico]	Taken into account - We now define it more broadly, also in the ES and the Glossary..

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22167	6	21	48	28	10	"The Marine Heatwave section miss out events of mass coral bleaching along Indian coast since 1998 especially in 2016. Also, on page 32, line 48-50 of this chapter says "The frequency and duration of heatwaves have increased over the Indian subcontinent and these events are associated with the Indian Ocean basin wide warming and frquent El Nino. The information may also be appropriately reflected in the Marine Heatwave section along with the incidences of coral reef bleaching alongside Indian coast." [NAYANIKA SINGH, India]	Taken into account - it is not our goal to list all MHWs in this chapter. In response to this comment, we now explicitly say that El Nino events can also impact SSTs in the Indian Ocean.
25711	6	21	48	28	10	"The incidence of mass coral bleaching due to marine heatwave along the Indian coast has had a significant impact on the ecosystem and its services. This information needs to be appropriately incorporated." [Government of India, India]	Taken into account - we show in Figure 6.3b that severe bleaching has happended in the Indian Ocean. However, we can not explain each bleaching event in detail in the text due to space constraints. Therefore we have not made any changes to the text as the Figure shows the bleaching events.
22295	6	22	1	22	4	Maybe better to phrase this around talking about MHWs as an emerging area of research since AR5 and SREX. Current phrasing doesn't convey this message. [Abram Nerilie, Australia]	Taken into account - we include that this is an emerging area of research since AR5.
31477	6	22	1	22	4	Wetthey et al 2011 does not reference a component of AR5 but is itself referenced in Chp 6. The Mediterranean (marine) heatwave event was discussed in AR5 WGII Chp 30 p1685 and thermal stress was also discussed eg Figure 30-4 [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - the entire introduction paragraph has been revised and Pörtner et al. (2014) is now referenced instead of Wetthey et al. (2011)
31479	6	22	3	22	4	this is misleading, MHW were only defined and named in 2016. Issues of anomalous short-term heat in the surface oceans have been included in past IPCC reports eg coral bleaching events [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - we have rewritten this introductory paragraph.
23415	6	22	6	22	31	I would suggest to add the reference such as Tan H, Cai R. What caused the record-breaking warming in East China Seas during August 2016? Atmos Sci Lett. 2018; e853. <a href="https://doi.org/10.1002/asl.853">https://doi.org/10.1002/asl.853</a> , in subsection 6.4.1.1 (Line 31). This paper depicts the record-breaking extreme SST event occured in the Pacific marginal sea, i.e., the East China Sea and analyse its climatic anomal attribution. [Rongshuo Cai, China]	Accepted - text revised.
31483	6	22	10	22	12	would go even earlier with mass coral bleaching events eg 1998 - see chp 30 AR5. Also in Chp 30, reference (p1685) is made to periods of extreme temperatures along the Mediterranean coastline in 1999, 2003 and 2006..... [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - This paragraph has been significantly reduced and we do not list every MHW anymore.
16553	6	22	10	22	31	A Marine Heatwave has been also mentioned in the Aegean Sea in June 2007 : Mavrakis, Anastasios F., and Ioannis X. Tsiros. "The abrupt increase in the Aegean Sea surface temperature during the June 2007 southeast Mediterranean heatwave–A marine heatwave event?" Weather. [Sofia Darmaraki, France]	Taken into account - This paragraph has been significantly reduced and we do not list every MHW anymore.
16555	6	22	10	22	31	On the Marine Heatwave in East China Seas : Tan, Hongjian, and Rongshuo Cai. "What caused the record-breaking warming in East China Seas during August 2016?." Atmospheric Science Letters 19.10 (2018): e853. [Sofia Darmaraki, France]	Accepted - text revised.
16557	6	22	10	22	31	About the MHW of 2017 on the Southwestern Atlantic Shelf : Manta, G., et al. "The 2017 record marine heatwave in the Southwestern Atlantic Shelf." Geophysical Research Letters 45.22 (2018): 12-449. [Sofia Darmaraki, France]	Taken into account - the Soutwest Atlatic 2017 MHW has now included into the Figure 6.3a and mentioned in the text.
31485	6	22	10	22	31	For all of these events, the processes are described below on page 24, could this section be shortened by combining these? eg in a table [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - we largely reduced the text on observed MHWs, but instead link to Figure 6.3a and Figure 6.2 and Table 6.2

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
8217	6	22	11	0		Change "MHW" to "MHWs" [Nina Hunter, South Africa]	Accepted - text revised.
17399	6	22	12	22	12	The data on seawater temperatures (3°C-5°C) needs revision. The temperature range, cited from old papers, is smaller than the actual: 3°C-5°C. Updates can be obtained from other sources such as Thomas L Frolicher et al., Nature Communication, 2018. [Louis Lubango, Ethiopia]	Rejected - we already say in the text that it is 1-3C. In any case, this text has now partly moved to Table 6.2 due to space constraints.
22029	6	22	13	22	14	Presumably, you are talking about anomalies, here? As far as I am aware, Western Australian water temperatures always exceed 5°C... [David Schoeman, Australia]	Taken into account - yes these are anomlies. Text has been revised and moved to Table 6.2
21757	6	22	29	22	31	Kim and Han(2017) explains not only the Yellow Sea, but also the MHWs in the Korea Waters. As an author, it would be reasonable to change this sentence to the Korea Waters rather than the Yellow Sea. [Government of Republic of Korea, Republic of Korea]	Taken into account - we now call it Yellow Sea / Sea of Japan MHW
22621	6	22	29	22	31	Kim and Han(2017) explains not only the Yellow Sea, but also the MHWs in the Korea Waters. As an author, it would be reasonable to change this sentence to the Korea Waters rather than the Yellow Sea. [IN-SEONG HAN, Republic of Korea]	Taken into account - we now call it Yellow Sea / Sea of Japan MHW
22623	6	22	29	22	31	Significant MHWs have been continuously occurred around the Korea Peninsula during summer since 2016. These occurrences of MHWs will be checked by following references. (Korea Meteorological Administration 2016, 2017 and 2018, Korea Extreme Climate Report). [IN-SEONG HAN, Republic of Korea]	Accpeted - text revised.
31487	6	23	0	0		You could be consistent with Chp 18 AR5 and the WGII SPM and use low, medium, high etc for attribution to climate change [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - we refer with our attribution statement only to the attriubtion of the hazard (i.g. extreme temperatures). We do not intent to attribute observed impacts to anthropogenic climate change. As a response to the comment, we changed the label in the figure 6.3.
21759	6	23	0	23		For the same reason, I would like to extend the area for Yellow Sea to Korea Water, which is included the Yellow Sea, Northern East China Sea and western part of East/Japan Sea in the Figure 6.3(a). [Government of Republic of Korea, Republic of Korea]	Taken into account - we now call the event Yellow Sea /Japan Sea MHW.
21761	6	23	0	23		Significant MHWs have been continuously occurred around the korean peninsula during summer since 2016. These occurrences of MHWs checked and will be checked by these references, "Korea Meteorological Administration, 2016, 2017, 2018. Korea extreme climate report"(in Korean, grey report) [Government of Republic of Korea, Republic of Korea]	addressed above
22625	6	23	0	23		For the same reason, I would like to extend the area for Yellow Sea to Korea Water, which is included the Yellow Sea, Northern East China Sea and western part of East/Japan Sea in the Figure 6.3(a). [IN-SEONG HAN, Republic of Korea]	Taken into account - we now call the event Yellow Sea /Japan Sea MHW.
23295	6	23	0	23		I suggest to replace the SPM figure on cyclones by a figure on marine heat waves linked to implications (obs and projections). [Valerie Masson-Delmotte, France]	Taken into account - This will be decided by the SPM author team.
32635	6	23	0	23		the label for the NE pacific MHW is located in the S Pacific. I get the space constraints, but maybe an arrow (grey color?) is necessary in those cases hwere the label is so far from the region of interest? [Kim Cobb, United States of America]	Rejected - we keep Figure as is as arrows would make the figure even busier.
32637	6	23	0	23		severe bleaching and 85% coral mortality at Kiritimati Island (and possibly Jarvis; Anne Cohen et al) should be documented here for the 2015/16 El Nino event; See Claar et al., PLOS1, 2018. Also summarized in Hughes et al., 2018 I believe; perhaps use that dataset if available? [Kim Cobb, United States of America]	Taken into account - We have now included the Kiritimati Island MHW

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22031	6	23	1	23	1	The use of MHW and DHW in close proximity is likely to cause confusion, because the "HW" part means different things. Even using DHDs might be better? [David Schoeman, Australia]	Taken into account - we now clearly state the difference between MHWs and DHWs at the beginning of the section.
22297	6	23	1	23	1	In figure 6.3a it isn't clear from the caption exactly what the colour map shading shows, or how this is related to MHWs [Abram Nerilie, Australia]	Taken into account - we now explicitly say that it is the maximum sea surface temperature anomaly during the MHW.
640	6	23	1	23	12	(b) What is a degree heating week? I couldn't locate a definition in the text. Also, this is a satellite product, suggesting it is the SST skin, which may not coincide with the depths the corals are living at. This should be pointed out in the caption. [Jenna Pearson, United States of America]	Taken into account - we now define DHW upfront the section. Also, differences between SST skin and SST bulk has been removed in the NOAA' Coral Reef Watch Daily Global 5km Satellite Coral Bleaching Heat Stress Monitoring Product Suite v3.1 (see Liu et al. 2014 for more details).
12927	6	23	1	23	13	Please consider to lift this highly important figure in the SPM. [Government of Germany, Germany]	Taken into account - This will be decided by the SPM author team.
3679	6	23	4	23	4	Please give the specific statistical period in figure 6.3. [Juncheng Zuo, China]	Taken into account - We now explicitly say that we used the 1982-2011 reference period.
21207	6	23	8	23	8	A reference to where the method for "de-seasonalising the data" should be included [APECS Group Review, Germany]	Rejected - This would be too much detail here, but the method is described in detail in Frölicher and Laufkötter (2018)
1759	6	24	1	0		Should be DHW, not DWH :- ) [Mark Payne, Denmark]	Accepted - text revised.
15851	6	24	1	0		Typo. It should be DHW, not DWH. [EUCE, Belgium]	Accepted - text revised.
8219	6	24	4	0		Insert "was" after "bleaching" [Nina Hunter, South Africa]	Accepted - text revised.
1753	6	24	8	24	30	All of the modes of variability listed here are typically associated with shorter-timescales (less than 10 years). What about longer (decadal to centennial) patterns of natural variability such as the Pacific Decadal Oscillation and the Atlantic Multi-decadal variability? [Nora Richter, United States of America]	Taken into account - we also added variability modes longer than 10 years.
8221	6	24	26	0		Suggest change "for" to "in" [Nina Hunter, South Africa]	Accepted - text revised.
22575	6	24	32	25	12	Suggest a discussion of the influences of decadal climate variability on MHWs, such as Pacific Decadal Oscillation; some of the conclusions on regional variations of MHWs could be partly due to the PDO variability. [Government of Australia, Australia]	Taken into account - we now also mention the PDO.
16559	6	24	34	24	58	Marine Heatwaves have been so far studied based on SST evolution and only a few studies have documented/taken into account extreme temperatures at depth during past, individual events. It would worth mentioning, however, that past and future evolution of extreme temperatures at depth, based on below surface temperature information has not been looked at yet, due to difficulties with available data, although it is key information (e.g. for fisheries) and there might be interesting links between surface events and how their heat is transported at depth. [Sofia Damaraki, France]	Taken into account - this is a good point. We now say: "Due to the scarcity of below surface temperature data with high temporal and spatial resolution, it is currently unknown how extreme temperatures at depth change under global warming."
28997	6	24	35	24	39	The period here is 1982-2016 or 35 years. However one should have at least 100 years of data to have an approximation of the 99 percentile. One could assume some probability distribution function but how to know is the right one, based on 35 years? In line 38, it is claimed that the number of exceedances has doubled in this same period. That is strange: if there is a trend in this 35 years period one cannot calculate any percentile since one assumes stationary weather conditions. [Government of Netherlands, Netherlands]	Rejected - please note that we used daily SST data over the 1982-2016 period, and not yearly data. This is consistent with Frölicher et al. (2018)
4605	6	24	40	24	40	rephrase to 'record warm global sea' [The UBern Team Group Review, Switzerland]	Accepted - text revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
8223	6	24	43	0		Change "exceed" to "exceeds" [Nina Hunter, South Africa]	Accepted - text revised.
12929	6	24	45	24	46	Please consider to lift this relevant information to the ES and to the SPM. [Government of Germany, Germany]	Taken into account - This will be decided by the SPM author team.
31489	6	24	46	24	48	this contradicts page 22 line 10-11, which states the first documented MHW was in 2003, here you refer to much earlier events as MHW [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - we have revised the text.
4607	6	24	48	24	48	it was 25 to 30 years in the early 1980s': This is unclear [The UBern Team Group Review, Switzerland]	Accepted - text revised.
8225	6	24	49	0		Suggest insert "a" before "long-term" [Nina Hunter, South Africa]	Accepted - text revised.
8227	6	24	54	0		Change "to due" to "due to" [Nina Hunter, South Africa]	Accepted - text revised.
21763	6	24	54	24	54	"to due anthropogenic warming" should be replaced with "due to anthropogenic warming" [Government of Republic of Korea, Republic of Korea]	Accepted - text revised.
21209	6	24	54	24	55	Text mentions "A few attribution studies" but cites only one to substantiate this. Either other relevant studies need to be included, or text needs to be amended. [APECS Group Review, Germany]	Accepted - text revised.
31491	6	24	55	24	56	According to Fig 6.3a, only 4 have been attributed to anthropogenic climate change and 5 have not - therefore not most. Please give the numbers [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - We now explicitly state that such attribution studies have not been undertaken for many marine heatwaves shown in Fig. 6.3 and it is therefore unclear if these MHWs have an anthropogenic signal or not (labelled as 'unknown' in Fig. 6.3a)
31493	6	25	1	25	3	do these fall into the definition of marine heatwave? [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - We now relate these attribution studies to the the MHWs shown in Figure 6.3a.
31495	6	25	1	25	4	not all of these are shown in Fig 6.3a [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - Yes, not all MHWs are shown in Figure 6.3a. We now explicitly say in the Figure 6.3 caption, that this is not a complete compilation of all documented MHWs.
8229	6	25	5	0		Suggest rephrase "nearly been all fully" to "nearly all been fully" [Nina Hunter, South Africa]	Accepted - text revised.
22299	6	25	5	25	5	"have nearly been all fully attributed to..." This is quite awkward wording. Please rephrase to improve clarity of text. [Abram Nerilie, Australia]	Accepted - text revised.
21211	6	25	6	25	7	This sentence can be strengthened by placing it within the context of the studies mentioned previous, i.e. "In other words, the forementioned studies show that such events are very rarely found or absent in preindustrial climate simulations". In its current phrasing, the sentence could be read as an unsubstantiated assertion. [APECS Group Review, Germany]	Accepted - text revised.
8231	6	25	11	0		Change "were" to "was" [Nina Hunter, South Africa]	Accepted - text revised.
31497	6	25	16	25	17	Do these projections apply to all oceans? and how much of the ocean surface? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - we now explicitly state that marine heatwaves will increase throughout the ocean under future global warming
4609	6	25	19	25	19	Clarify that global atmospheric surface temperature is meant [The UBern Team Group Review, Switzerland]	Accepted - text revised.



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22303	6	25	22	25	27	These quantified numbers are very informative! Based on Figure 6.4 it looks like estimates are also possible for RCP2.6 and 8.5 for roughly near term (2031-2050) and end-of-century (2081-2100). For consistency in the treatment of time intervals across the report it would be very helpful to also report MHW projection numbers in this way. This would also aid incorporation of this information into figure 1 of the SPM. [Abram Nerilie, Australia]	Accepted - we included the numbers in the text.
31499	6	25	23	25	24	1.5 is below 2C. do you mean at 2C? [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - text revised.
4611	6	25	27	25	27	changes 2x 'is' to 2x 'will be' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
23417	6	25	29	25	31	Following Fig. 6.4b, how could we see that "the largest changes in the probability of MHWs will occur in the Arctic Ocean and the western tropical Pacific (Figure 6.4b)" ? Based on the dark or light color of Fig. 6.4b, the largest changes in the probability of MHWs seemingly appear in the Arctic Ocean and the tropic ocean, not only in the western tropical Pacific ? [Rongshuo Cai, China]	Taken into account - we now use a linear color scale to highlight that both the tropical Pacific and the Arctic Ocean will experience the largest increases in the probability ratio.
4613	6	25	30	25	30	change 'changes' to 'increase' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
8233	6	25	31	25	32	Suggest change "are projected also to" to "will also" as projected has already been stated [Nina Hunter, South Africa]	Accepted - text revised.
4615	6	25	35	25	35	rephrase to 'partly due to' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
21213	6	25	36	25	36	Is it possible to state what is meant by "higher resolution models"? i.e. a maximum grid size and/or the ability of the model to resolve certain processes. This should either be addressed here or as part of the overall glossary of terms. [APECS Group Review, Germany]	Accepted - we now explicitly state that we mean eddy-resolving ocean models.
10841	6	25	36	25	41	it preferable to show the link between the MHW and the increasing number of strong convective storms over the western Mediterranean Sea and coastal regions during the last 20 years. [khadija kadibi, Morocco]	Accepted - we now say that MHWs in the Mediterranean Sea can also trigger extratropical cyclones over the Mediterranean Sea.
12931	6	25	38	25	39	Please consider to lift this relevant information to the ES. [Government of Germany, Germany]	Taken into account - This will be decided by the SPM author team.
16567	6	25	39	25	39	Darmaraki et al 2018, will probably be Darmaraki et al 2019, [Sofia Darmaraki, France]	Accepted and updated.
21215	6	25	44	25	44	Is it possible to state what is meant by "coarse resolution climate models"? i.e. a minimum grid size and/or the ability of the model to resolve certain processes. This should either be addressed here or as part of the overall glossary of terms. [APECS Group Review, Germany]	Accepted - we now explicitly state that we mean with high resolution models. We also add that we mean with coarse-resolution models CMIP5-type Earth system models.
16565	6	25	46	25	47	What about the effect of the SST variability in general ? It might play a rôle everywhere not just in the Arctic [Sofia Darmaraki, France]	Good question. Outside the Arctic, the impacts of changes in variability on MHW characteristics are smaller than the impacts due to gradual mean warming, at least that is what CMIP5 models suggest (see Frölicher et al. 2018) No changes are made.
22301	6	25	49	25	51	It would be helpful to explain why MHWs are expected to increase more than land-based heat waves (presumably this is because of the high heat capacity of water and reduced variability of ocean temperatures relative to air temperatures). [Abram Nerilie, Australia]	Taken into account - this is because the temperature variability in ocean surface waters is much smaller than in the atmosphere. We now explain this in the text.
4617	6	26	0	26		Please specify what 'probability ratio' is [The UBern Team Group Review, Switzerland]	Accepted - text revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
642	6	26	1	26	11	The idea of a probability ratio is missing here and in the text. It should be defined. [Jenna Pearson, United States of America]	Accepted - text revised in the Figure caption.
12933	6	26	1	26	11	Please consider to lift this highly relevant figure in the SPM. [Government of Germany, Germany]	Taken into account - This will be decided by the SPM author team.
22577	6	26	1	26	11	Suggest reconsidering the probability ratio. Currently it is not a very intuitive index and the scale is well explained in figure caption. [Government of Australia, Australia]	Accepted - we now define the probability ratio in the Figure caption and use a linear scale.
4619	6	26	9	26	9	change 'MHW days' to 'probability ratio of MHWs' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
31501	6	26	14	0		very limited use of uncertainty language in this section [Hans-Otto Poertner and WGII TSU, Germany]	Taken into account - We now included at the end of each section a summary statment with uncertainty language.
32639	6	26	37	26	39	Yes, this is more accurate - perhaps include in map Figure 6.3 then. [Kim Cobb, United States of America]	Taken into account - we now highlight the regional differences in bleaching severity in the Great Barrier Reef.
4621	6	26	38	26	38	add 'seabird abundance' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4623	6	26	44	26	44	rephrase to 'in a regime shift ' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4625	6	27	3	27	3	change 'significant' to 'substantial' and put some numbers [The UBern Team Group Review, Switzerland]	Accepted - we now explicitly state the numbers.
4627	6	27	4	27	4	what effects? [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4629	6	27	10	27	10	put Pseudo-nitzschia' in italics [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4631	6	27	11	27	11	poisoning of what? [The UBern Team Group Review, Switzerland]	Accepted - text revised.
22857	6	27	11	27	13	While it would be nice if people actually cared that much about marine mammals, the extend closures were due to elevated toxins in commercially harvested fish and invertebrates, not because there was a pulse of stranded marine mammals (obviously related but the strandings did not lead to the closures) [Raphael Kudela, United States of America]	Accepted - text revised. Many thanks for the clarification.
4633	6	27	12	27	13	rephrase to ' and prolonged and geographically extensive closure of rock crab, razor clam, and crab fisheries occurred.' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4635	6	27	16	27	16	replance 'including' by 'by causing' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
4637	6	27	26	27	26	change to 'large number of different marine organisms' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
12935	6	27	32	27	32	Please check if these impacts are "very likely". [Government of Germany, Germany]	Taken into account - after discussion with the chapter team, we now say that our statement has high confidence.
34049	6	27	35	0		Increased marine heat waves also reduce FOG along the coast. [Government of United States of America, United States of America]	Rejected - we could not find any literature that links fog with marine heatwaves.
5111	6	27	37	27	52	Consider providing assessment statement for the projected changes [Debra Roberts and Durban Team, South Africa]	Taken into account - we inluded a confidence statement.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16561	6	27	37	27	52	Could Marine Heatwaves have an impact on local circulation patterns that has not been investigated yet ? [Sofia Darmaraki, France]	Taken into account - Yes, we already say that it remains unclear how the projected increase in MHW intensity and frequency will impact the physical systems over land. No changes to the text has been made.
8235	6	27	43	0		Change "American" to "America" [Nina Hunter, South Africa]	Accepted - text revised.
4639	6	27	43	27	43	change to 'South America' [The UBern Team Group Review, Switzerland]	Accepted - text revised.
16563	6	27	44	27	45	On the effect of the Mediterranean Marine Heatwave of 2003 on the atmospheric heatwave of the same year : Feudale, L., and J. Shukla. "Role of Mediterranean SST in enhancing the European heat wave of summer 2003." Geophysical Research Letters 34.3 (2007). [Sofia Darmaraki, France]	Accepted - many thanks for the pointer.
22305	6	27	49	27	50	"...on temperature gradients within the climate system, such as those associated with extreme ENSO events (see Section 6.5) or the mean climate...". The phrasing here makes it seem like the temperature gradients are associated with extreme ENSO events or mean climate. I think what is actually meant is that MHW impacts will depend on both temperature gradients and changes in mean climate. [Abram Nerilie, Australia]	Accepted - text revised.
17401	6	27	56	28	24	The discussion focuses on the economic impact yet the heading refers to human system, not human activities. The heading and/or its content, discussion, need substantial revisions. A discussion on the impact on the human system is absent. If the section's heading is to remain as planned, it will be reasonable to emphasize some well-known impacts and risks induced by climate change and MHW on the human system. Otherwise, the section's content will very likely frustrate the readers. If such a description is impossible, it would be reasonable to rephrase the heading, freeing it for e.g. from the standing reference to human system, which has not been addressed to the extents anticipated by reasonable readers. The discussion can be enriched with the extent works including statistics (Table and Figures it was done on other impacts) on the effects of climate change, draught and MHW on social mobility, vulnerability and other social instabilities. Related works of ILO, UNEP, UNECA and other groups could be helpful. The discussion should emphasize that the effects of MHW, climate and other environmental changes are increasing although they tend be entangled with the social, economic and political causes. Although such an entanglement confound their discrimination, their effect cannot be reasonably discounted. Some cases from the horn of Africa, Sahel region, SIDs, India, Philippines, Cuba, Indonesia and US could be helpful. [Louis Lubango, Ethiopia]	Taken into account - we now also discuss the impact of MHWs on human health.
12937	6	27	57	27	57	Why is there only medium confidence? To us, this seems like a factual statement, which would be qualified as at least "very likely". Please explain or revise. [Government of Germany, Germany]	Taken into account -we removed the confidence statement here, but included a revised version towards the end of the section. We still argue that there is medium confidence, because studies on the impact of MHWs on human health are still scarce.
23299	6	28	0	28		Health implications of marine heat waves to be covered. [Valerie Masson-Delmotte, France]	Taken into account - we now state that marine heatwaves can impact human health.
8237	6	28	2	28	3	Suggest move "in 2015" to after "industry" [Nina Hunter, South Africa]	Accepted - text revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
34051	6	28	9	28	9	How about instead of "lobstermen" use "lobster fisheries" or something else gender neutral? [Government of United States of America, United States of America]	Accepted - text revised.
4641	6	28	17	28	18	Connection unclear. Also include reference [The UBern Team Group Review, Switzerland]	Accepted - text revised.
22307	6	28	17	28	18	"Ice-based harvesting of seals, crabs and fish in western Alaska was delayed due to the lack of winter sea ice, which caused oyster farm closures". I wouldn't have thought that winter sea ice and oyster farm closures were related? [Abram Nerilie, Australia]	Accepted - text revised.
12939	6	28	20	28	23	Please include this important finding in the ES. Please consider it for the SPM as well. [Government of Germany, Germany]	Rejected - after discussion with the chapter team we decided not include it in the ES.
22311	6	28	25	29	10	What about biological adaptation options. E.g. genetic selection of resilient marine species. [Abram Nerilie, Australia]	Taken into account - biological adaption options are detailed in chapter 5.
8239	6	28	37	0		Suggest change "preparations" to "preparation" [Nina Hunter, South Africa]	Accepted - text revised.
14637	6	28	41	28	42	We suggest revising the following sentence as follows: "Skilful multi-annual to decadal SST predictions may also inform and improve decisions about spatial and industrial planning, as well as the management of various extractive sectors such as the adjustments to quotas for internationally shared fish stocks". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - text revised.
1761	6	28	43	0		Additional reference on reviewing current state of the art in the development and useage of ecological forecast products based on seasonal-forecast systems: Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. <i>Frontiers in Marine Science</i> , 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [Mark Payne, Denmark]	Accepted - reference included.
15853	6	28	43	0		Additional reference on reviewing current state of the art in the development and useage of ecological forecast products based on seasonal-forecast systems: Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. <i>Frontiers in Marine Science</i> , 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [EUCE, Belgium]	Accepted - reference included.
8241	6	28	45	0		Is a comma necessary between "mixes" and "transferring"? [Nina Hunter, South Africa]	Accepted - yes a comma was needed.
9241	6	28	47	28	49	The reference to spatial planning is out of context, probably it refers to resource manangement, or more specifically to fisheries management [Urbano Fra.Paleo, Spain]	Accepted - text revised.
8243	6	28	49	0		Insert "the" before "occurrence" [Nina Hunter, South Africa]	Accepted - text revised.
1763	6	28	51	0		Barriers and lessons learned about the development and useage of such ecological forecast products are discussed in detail here: Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. <i>Frontiers in Marine Science</i> , 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [Mark Payne, Denmark]	Accepted - text revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
15855	6	28	51	0		Barriers and lessons learned about the development and useage of such ecological forecast products are discussed in detail here: Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. <i>Frontiers in Marine Science</i> , 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [EUCE, Belgium]	Accepted - text revised.
34053	6	29	1	0		Add information on effects of ENSOs on reproduction of marine birds and marine mammals. There are several articles on effects of ENSOs and reduced reproduction in common murrees at Farallon islands and Point Reyes and elsewhere, and on California sea lions on Channel islands National Park and harbor seals at Point Reyes. [Government of United States of America, United States of America]	Rejected.
4643	6	29	9	29	9	replace 'i.e.' with e.g. [The UBern Team Group Review, Switzerland]	Accepted - text revised.
24853	6	29	10	29	11	It is recommended to monitor those parts of the oceans from where researchers have no (or not enough) information about the expected impacts to make the necessary predictions. [Government of Hungary, Hungary]	Taken into account - we now refer to Argo and deep Argo floats at subsurface and how they can help to understand subsurface marine heatwaves.
22315	6	29	17	30	21	I was expecting to see some information here about changes/variability in the location of maximum warming associated with different flavours of El Nino events, and the importance that these aspects have on the impacts that El Nino events cause. [Abram Nerilie, Australia]	Rejected.
34055	6	29	19	29	19	Define SREX here because it is the first use in the chapter: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). [Government of United States of America, United States of America]	Accepted – text revised
2719	6	29	19	29	26	There are recent studies on future extreme El Nino and La Nina event. Based on the Coupled Model Intercomparison Project phase 5 (CMIP5) simulations it is projected a near double in the frequency of future extreme La Niña events (Nino4 index <-4), from one in every 23 years to one in every 13 years. Wenju et al., 2015, Increased frequency of extreme La Niña events under greenhouse warming, <i>Nature Climate Change</i> , DOI: 10.1038/NCLIMATE2492 that defines Extreme ( Niño4  > 1.75 s.d.), moderate (1.0 s.d. <  Niño4  < 1.75 s.d.) and weak (0.5 s.d. <  Niño4  < 1.0 s.d. [Thian Yew Gan, Canada]	This is already in the text
8245	6	29	25	0		Insert "a" before "limited" [Nina Hunter, South Africa]	Accepted – text revised
22313	6	29	28	29	29	"Paleo-ENSO studies suggest that there were epochs of strong ENSO variability throughout the Holocene, with no evidence for a systematic trend in ENSO variance". I don't believe that this is an accurate reflection of the Cobb et al., 2013 findings. They state that ENSO was highly variable throughout the Holocene with no evidence of a systematic trend, which is different to saying that there were epochs of strong ENSO variability throughout the Holocene. In their compilation, the variability of the 20th century stands out as being unusually high, but can't be said to be unprecedented in the context the full range of variability recorded during the Holocene. See Figure 2a of Cobb et al., 2013 paper. [Abram Nerilie, Australia]	Accepted – text revised

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14639	6	29	28	29	31	General: the chapter on high mountains does not mention at any point the potential for population influx into mountain regions as temperatures on adjacent plains increases and the extent to which this may increase vulnerabilities as changes occur to the cryosphere (reduced water flows, land slips etc). On the other hand, the chapter also does not really discuss out-migration (temporary) as an adaptation strategy (particularly young men). Both these issues are of importance to High Asia mountains. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected - not related to the chapter
11503	6	29	28	29	37	Recent paleo-ENSO reconstruction suggests that CP type El Nino has increased: Liu et al. 2017 doi: 10.1038/ncomms15386 [Anson Cheung, United States of America]	Accepted – text revised
2591	6	29	34	29	37	As already pointed out in my review of the FOD, it is not only the length of observational records that limits our ability to describe ENSO properties change in the historical period but also the quality of the data before 1950. The following references make this clear and can be cited in support of this important point: Giese, B. S., and S. Ray (2011), El Niño variability in simple ocean data assimilation (SODA), 1871–2008, J. Geophys. Res., 116, C02024, doi:10.1029/2010JC006695 Giese, B.S., G.P. Compo, N.C. Slowey, P.D. Sardeshmukh, J.A. Carton, S. Ray, and J.S. Whitaker, 2010: The 1918/19 El Niño. Bull. Amer. Meteor. Soc., 91, 177–183, <a href="https://doi.org/10.1175/2009BAMS2903.1">https://doi.org/10.1175/2009BAMS2903.1</a> [Eric Guilyardi, France]	Accepted – text revised
32641	6	29	36	29	37	Specify that INSTRUMENTAL observations are too short to assert these changes, but that does not erase them from the paleoclimate record, nor the observation that these studies, with our best nulls, suggest a statistically significant increase in ENSO variance in recent decades. This could be hydrological in nature, supporting the increase in ENSO-driven hydrological impacts noted above, or it could be an increase in SST variance, as suggested in Cai et al., 2019. This section needs a better last sentence, and a stronger nod to the emergence of a signal using our best paleoclimate records. I'm also wondering why there is no depiction of changing ENSO variance through time, combining paleo and obs? [Kim Cobb, United States of America]	Accepted – text revised
2587	6	29	37	29	37	I find the use of "high confidence" inappropriate in this context. Shouldn't the phrase be changed to use "low confidence" rather? E.g 'Because of these limitations (length and quality of record) there is "low confidence" in these changes.' [Eric Guilyardi, France]	Rejected - sentence has been rephrased
11501	6	29	47	30	21	A more recent study also show a robust increase in EP-SST ENSO variability in the future: Cai et al. 2018 doi: 10.1038/s41586-018-0776-9 [Anson Cheung, United States of America]	Accepted - text revised
1767	6	29	48	0		A note here about why El Nino is defined as a rainfall threshold, rather than the SST anom in the Nino 3.4 region (for example) could be useful for the ocean-oriented community [Mark Payne, Denmark]	This has been a new definition developed since AR5. A more recent paper that also looks at SST indices is also cited
15857	6	29	48	0		A note here about why El Nino is defined as a rainfall threshold, rather than the SST anom in the Nino 3.4 region (for example) could be useful for the ocean-oriented community. [EUCE, Belgium]	This has been a new definition developed since AR5. A more recent paper that also looks at SST indices is also cited

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
10251	6	29	48	30	11	It should be noted the definition of El Nino is normally based of the SST anomalies of the Nino regions or the Southern Oscillation Index. Examples: <a href="http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php">http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php</a> <a href="http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/elmonout.html#table">http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/elmonout.html#table</a> <a href="http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml">http://www.bom.gov.au/climate/updates/articles/a008-el-nino-and-australia.shtml</a> <a href="https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-iri_update">https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-iri_update</a> The definition of El Nino based on precipitation does not reconcile with the definitions adopted by major climate centres. A remark should be given to alert the readers. [SAI MING LEE, China]	This has been a new definition developed since AR5. A more recent paper that also looks at SST indices is also cited
22317	6	29	50	29	50	A rainfall "increase" of greater than 5 mm per day, or rainfall average of greater than 5 mm per day? [Abram Nerilie, Australia]	Increase. Text retained
31503	6	29	52	29	53	Updating Fig 14.13 in WGI AR5, would help the reader [Hans-Otto Poertner and WGII TSU, Germany]	This is a rather standard figure (NINO3 index) that a reader can easily find on the web
34057	6	29	55	29	56	Regarding classification of the 2015/2016 El Nino among the three warmest ENSO events in the instrumental record, specify how many ENSO events exist in the instrumental record because the average reader isn't going to know. [Government of United States of America, United States of America]	Accepted - text revised
22309	6	29	56	29	57	A new government where? (US? Peru?). Also "hindered" may not be the best word in this context. [Abram Nerilie, Australia]	Accepted, text revised
1765	6	30	4	30	7	This paragraph could be dropped - it doesn't seem to add much [Mark Payne, Denmark]	Accepted - text removed
10089	6	30	4	30	7	I would remove the whole paragraph. It is incorrect to highlight only the relationship between ENSO and IOD. Alternatively, what about the relationship of ENSO to PDO or AMO? (see the ENSO-PDO relationship in the paper by Wang et al., 2014 (Combined effects of the Pacific Decadal Oscillation and El Niño-Southern Oscillation on Global Land Dry–Wet Changes, Scientific Reports, vol 4: 6651) and ENSO-AMO relationship in the paper by Levine et al., 2017 (The impact of the AMO on multidecadal ENSO variability, Geophys. Res Letters, vol 44: 8)). In general, I would recommend either to omit IOD teleconnections or to include IOD, PDO and AMO. [Elsa Arellano-Torres, Mexico]	Accepted - text removed
15859	6	30	4	30	7	Please, consider deleting this paragraph as it doesn't seem to add much. [EUCE, Belgium]	Accepted - text removed
22319	6	30	4	30	7	This paragraph seems out of place in this position? [Abram Nerilie, Australia]	Accepted - text removed
34059	6	30	4	30	7	A shift in the SPCZ is interesting but the consequences are not described. [Government of United States of America, United States of America]	Accepted - text removed
21217	6	30	9	30	21	This paragraph makes a series of assertions regarding the projected impact of changing El Nino/La Nina events. Can confidence statements be added to these projections? [APECS Group Review, Germany]	Accepted - text revised
22323	6	30	9	30	21	Because past IPCC assessments have found no clear consensus on changes in ENSO variability I think that more should be said here for why there now appears to be evidence for an increase in extreme El Nino events in the future. In particular it could be made clearer that using traditional SST metrics there isn't clear agreement between models, but by looking at El Nino rainfall impacts future changes become more evident. [Abram Nerilie, Australia]	Accepted, text revised

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31505	6	30	9	30	21	Please check and also refer to SR15 Chp 3 section 3.5.2.5 [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - text revised
8247	6	30	12	0		No definition provided for La Nina - this is noteworthy since there is a definition for El Nino. Please provide definition. [Nina Hunter, South Africa]	Accepted - text revised
792	6	30	12	30	14	Extreme La Nina events are not defined in previous paragraphs along with extreme El Nino events. [Mengxi Wu, United States of America]	Accepted - text revised
22321	6	30	14	30	16	It would be helpful to explain why it is thought that the swings between El Nino and La Nina will occur more frequently in the future. [Abram Nerilie, Australia]	Rejected - Description of the mechanism avoided due to lack of space.
34061	6	30	18	30	19	This sentence deserves a confidence level because it does not appear to be citing a particular paper but appears to be a statement that comes from the analysis of many CMIP5 studies. [Government of United States of America, United States of America]	Accepted - text revised
31743	6	31	1	0		Figure 6.5. The caption refers to the line (only the horizontal in panel A) as being a dashed line, but it is a solid line. This part of the caption seems to apply to both panels. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - figure caption has been corrected.
794	6	31	1	31	1	It is not very clear from both panels whether RCP8.5 is associated with more extreme El Nino events compared with RCP2.6. If not, then the connection between global warming and the frequency of extreme El Nino events seems less robust. [Mengxi Wu, United States of America]	Accepted - the caption for Fig. 6.5 has been modified to highlight that there are more extreme El Niño events under RCP8.5
21219	6	31	1	31	1	In the data presentation it would be useful to avoid combinations of reds and greens for colourblind readers. [APECS Group Review, Germany]	Accepted - colour palette has been modified
8249	6	31	4	0		Write "Dec-Feb" in full without abbreviating [Nina Hunter, South Africa]	Accepted - text revised
10091	6	32	2	32	20	See previous comment. In general, I would recommend either to omit IOD teleconnections or to include IOD, PDO and AMO modes of variability in more precise subsections. [Elsa Arellano-Torres, Mexico]	Rejected - It is not IOD teleconnections but IOD extremes and abrupt warming in the Indian Ocean which is included here.
8251	6	32	12	32	14	Why is "Throughflow" capitalised but "circulation" not? [Nina Hunter, South Africa]	Rejected - standard usage
8253	6	32	16	0		Insert "a" after "from" [Nina Hunter, South Africa]	Accepted - text revised
21221	6	32	16	32	17	Can a confidence statement be added to the projection that "IOD events [are] projected to increase by almost a factor of three"? [APECS Group Review, Germany]	Accepted - text revised



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2807	6	32	16	32	20	<p>Some important advances in IOD change under global warming are missed here. Suggestion: "The dynamic processes on the changes in IOD under global warming are quite complicated with large intermodel spread (Cai et al. 2013). However, there is a robust change found in CMIP5 model projections that the extreme pIOD events defined on rainfall anomalies are likely increased (Cai et al. 2014), which could be induced by the mean-state SST changes in the Indian Ocean (Luo et al. 2016). Future studies also suggest that the common bias in the CMIP5 model could artificially enlarge the increase in the extreme pIOD events (Li et al. 2016), and the internal variability of the tropical climate could also influence the projection of IOD changes under global warming (Hui and Zheng 2018)."</p> <p>Refs:  Cai, W., and Coauthors, 2013: Projected response of the Indian Ocean dipole to greenhouse warming. <i>Nat. Geosci.</i>, 6, 999–1007  Cai, W., and Coauthors, 2014: Increased frequency of extreme Indian Ocean dipole events due to greenhouse warming. <i>Nature</i>, 510, 254–258.  Luo, Y., J. Lu, F. Liu, and X. Wan, 2016: The positive Indian Ocean Dipole-like response in the tropical Indian Ocean to global warming. <i>Advances in Atmospheric Sciences</i>, 33: 476-488.  Li, G., S.-P. Xie, and Y. Du, 2016: A robust but spurious pattern of climate change in model projections over the tropical Indian Ocean. <i>J. Climate</i>, 29, 5589-5608  Hui, C., and X.-T. Zheng, 2018: Uncertainty in Indian Ocean dipole response to global warming: The role of internal variability. <i>Climate Dynamics</i>, 51, 3597–3611 [Ping Huang, China]</p>	Accepted - text revised
22325	6	32	16	32	20	There are also a number of studies post AR5 that point to multi-decadal modulation of IOD variability related to Pacific -connected thermocline changes and the implications that this has for improved predictability. [Abram Nerilie, Australia]	Accepted - text revised
29003	6	32	22	32	22	Confounding -> should be "Compounding"? [Government of Netherlands, Netherlands]	Rejected.
10093	6	32	24	32	24	The sentence could begin with "ENSO and other modes of variability are..." [Elsa Arellano-Torres, Mexico]	Text removed.
17403	6	32	24	33	32	Again, the discussion on impacts on human system is weak. This needs revision as previously mentioned. [Louis Lubango, Ethiopia]	Accepted; revision made to improve the discussion on the impacts on human systems.
23419	6	32	32	32	34	Are there the robust and agreement documented evidences in this only cited paper (Caminade et al., 2017)? Otherwise, it needs explaining why the author can get the "likely" assessment result. [Rongshuo Cai, China]	Noted; revised text includes the spread/outbreak of diseases in different parts of the globe with more references added.
8255	6	32	36	0		"extensive" twice in same sentence - consider another word [Nina Hunter, South Africa]	Accepted; text revised.
23971	6	32	40	32	40	Would it not be better to use "Global SST" instead of "Global Ocean SST". [Government of Japan, Japan]	Accepted; text revised.
12133	6	32	40	32	46	The description in Lines 40-42 should be reconfirm according to the reference. I suggest to add the description on the reliability on the weakening Indian monsoon and related precipitation. [Jianqi Sun, China]	Rejected

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23421	6	32	40	32	52	In this paragraph, studies present disagreement results, e.g., the responses of monsoon system across NH and Indian regions to warmer climate vary quite differently. Furthermore, not only Indian monsoon (Mishra et al., 2012; Roxy et al., 2015), but also East Asian monsoon, experienced an inter-decade weakening since the 1960s (e.g., Cai R S, Tan H J, Kontoyiannis H. 2017. Robust surface warming in offshore China seas and its relationship to the East Asian Monsoon wind field and ocean forcing on interdecadal time scales [J]. J. Climate, 30(22): 8987–9005, doi:10.1175/JCLI-D-16-0016.1.). I am wondering if the author can consider why or how Mega-El Nino impact on the global or regional monsoon quite different? What assessment results can we have? [Rongshuo Cai, China]	Rejected; suggested reference does not related to changes in East Asian monsoon due to extreme El Nino or Indian Ocean warming.
14641	6	32	42	32	42	We suggest revising the following sentence as follows: The Pacific cooling pattern is often synonymous with predominance of La Niña events in the 2000s that had significant impacts on terrestrial carbon uptake [del: via teleconnections.] [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted; text revised.
21223	6	33	1	33	4	Can a confidence statement be added to this projection? [APECS Group Review, Germany]	Accepted; text revised.
12941	6	33	8	33	13	This passus can be removed. [Government of Germany, Germany]	Rejected
8257	6	33	11	0		Insert "to" after "due" [Nina Hunter, South Africa]	Accepted; text revised.
11505	6	33	15	33	32	Other studies that have assessed ENSO teleconnection changes: Perry et al. 2017, doi: 10.1002/2017GL074509 ; Zhou et al. 2014, doi: 10.1175/JCLI-D-14-00254.1 [Anson Cheung, United States of America]	Rejected; suggestion does not deal with extreme El Nino cases or do not add extra information other than presented.
22579	6	33	27	33	27	Suggest clarifying the meaning of the term "in sign". [Government of Australia, Australia]	Accepted; text revised.
22581	6	33	27	33	28	Suggest expanding the JJA and DJF acronyms for the reader in the first instance. It would be useful to explain these (and all) acronyms. [Government of Australia, Australia]	Accepted; text revised.
22583	6	34	0	34	0	Suggest including a descriptive label for the 'sun with cloud' symbol. [Government of Australia, Australia]	Accepted, figure revised
644	6	34	1	34	9	Label the colorbar. Are there magnitudes to be included with the arrows indicating the direction of change? A legend for the arrows could be a good idea. [Jenna Pearson, United States of America]	Accepted, figure revised
8259	6	34	2	0		Remove "of" and replace with "by" [Nina Hunter, South Africa]	Rejected
1769	6	34	2	0	9	Significance is not the right word to use here, as it implies a statistical test (which apparently hasn't been done). "Model consensus" might be a better phrase [Mark Payne, Denmark]	accepted
15861	6	34	2	0	9	Significance is not the right word to use here, as it implies a statistical test (which apparently hasn't been done). "Model consensus" might serve the purpose. [EUCE, Belgium]	accepted
5271	6	34	2	34	9	Figure 6.6 - Don't have references [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted, reference added

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10095	6	34	2	34	9	Figure 6.6 needs to clarify where are "panel a" and "panel b" mentioned in the figure caption. It could be appropriate to place in the bold title of upper and lower figures: (a) Jun-Aug; (b) Dec-Feb. [Elsa Arellano-Torres, Mexico]	Accepted, figure revised
12943	6	34	2	34	9	There are no markers for subplots a) and b) in the Fig. 6.6 either add or replace by up and down [Government of Germany, Germany]	Accepted, figure revised
23973	6	34	4	34	4	The words "panel a" and "panel b" do not appear in the main text. We would suggest reconsideration of whether they are necessary or not. [Government of Japan, Japan]	accepted
5273	6	34	15	34	15	In the text maybe included the infrastructure [CRISTOBAL FELIX DIAZ MOREJON, Cuba]	Accepted - text revised
12945	6	34	21	34	22	Fig. 6.6: It is not clear what the sun/cloud-icon means. In general, Fig. 6-6 needs to be improved considerably in order to help the reader understand changes in teleconnections. It would help to have a legend with icons and arrows explained, instead of explaining it solely in the caption. [Government of Germany, Germany]	Accepted, figure revised
11739	6	34	25	34	28	This sentence misses an opportunity to reinforce planning actions that can reduce exposure to such events. We cannot wait for better understanding of the impacts to take adaptive actions. Suggest the following is added to this sentence. " In the meantime precautionary planning actions can reduce ongoing exposure to such extremes events (REF). It is a mistake to convey that only better understanding of impacts will address the problem. Future proofing our settlements and activities in areas known to experience extreme events will also be necessary. To only focus on more impacts information will elicit a response of delayed adaptation action. There is a long and wide literature to support this which should be known to the Chapter authors for adding here. Search on adaptation planning/ delayed adaptation action etc would get them. [Judy Lawrence, New Zealand]	Accepted, text revised
25829	6	34	25	34	28	Suggestion: Include (I know maybe doesn't exist, but we can work in that) the procedure how to determine the impact, thinking in the implementation of the adaptation, or maybe said TO DETERMINE THE IMPACT WILL BE CONSIDER THAT IS LOCALLY. That is because is not understood for the people and desicion makers thta Climate Change is globally but the impacts need to define locally. [ELIZABETH SILVESTRE, Peru]	rejected, unclear suggestion
5115	6	35	6	35	10	Drop "EWEs" and "WWEs" as they are both used only twice in the chapter. [Debra Roberts and Durban Team, South Africa]	Accepted - text revised
22327	6	35	6	35	10	Avoid acronyms for WWEs and EWEs - they aren't necessary and make the text harder to follow. [Abram Nerilie, Australia]	Accepted - text revised
8261	6	35	11	0		Suggest replacing "on" with "of"; suggest replacing "helps" with "contributes towards" [Nina Hunter, South Africa]	accepted - text revised
8263	6	35	12	35	14	Please rephrase sentence so that meaning is clear [Nina Hunter, South Africa]	Accepted; text revised.
8265	6	35	19	0		Suggest insert "An" before "Early warning system" [Nina Hunter, South Africa]	Accepted - text revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
3943	6	35	26	35	35	There are already several examples of insurance systems covering ENSO-related losses. For example, an Extreme El Nino Insurance product in Peru is designed to pay policyholders using an index based on a SST indicator that is observed months before the onset of heavy El Nino-associated precipitation ( <a href="http://seguros.riesgoycambioclimatico.org/publicaciones/Nota-Tecnica2-eng.pdf">http://seguros.riesgoycambioclimatico.org/publicaciones/Nota-Tecnica2-eng.pdf</a> ). This enables insurance payouts to be used to finance loss prevention strategies prior to the onset of rainfall. Also in Peru is an Agricultural Catastrophe Insurance scheme (El Seguro Agrario Catastrofico - SAC), which protects farmers from El Nino-related flooding ( <a href="http://www.artemis.bm/blog/2017/05/19/peru-to-expand-el-nino-agricultural-catastrophe-insurance-cover/">http://www.artemis.bm/blog/2017/05/19/peru-to-expand-el-nino-agricultural-catastrophe-insurance-cover/</a> ). However, there continues to be a substantial protection gap. For example, it is estimated that insurance covered only 7% of the \$9 billion of property damage in Peru associated with the 2017 El Nino ( <a href="https://www.businessinsurance.com/article/20180130/STORY/912318820/Insurance-covers-7-of-\$9-billion-El-Nino-related-damage-">https://www.businessinsurance.com/article/20180130/STORY/912318820/Insurance-covers-7-of-\$9-billion-El-Nino-related-damage-</a> ). If insurance schemes are index-based rather than indemnity-based, basis risk may be an issue. Another example of a financing mechanism for El Nino-related flood risk management in Peru is the forecast-based financing approach developed by the Red Cross ( <a href="http://climatecentre.org/downloads/files/NotaTecnicaFEN%20-%20Ingles%20set2016.pdf">http://climatecentre.org/downloads/files/NotaTecnicaFEN%20-%20Ingles%20set2016.pdf</a> ; <a href="http://www.ifrc.org/fr/nouvelles/nouvelles/americas/peru/red-cross-readies-forecast-based-action-as-heavy-rains-blamed-on-el-nino-lash-peru--71976/">http://www.ifrc.org/fr/nouvelles/nouvelles/americas/peru/red-cross-readies-forecast-based-action-as-heavy-rains-blamed-on-el-nino-lash-peru--71976/</a> ). [Michaela Dolk, United States of America]	Many thanks for the suggestions, these are now included.
8267	6	35	32	0		"specific" mentioned twice after a few words - consider another word [Nina Hunter, South Africa]	Accepted - text revised
8269	6	35	33	0		Insert "and" before "Aguilera" [Nina Hunter, South Africa]	Accepted - text revised
22339	6	35	38	37	55	In general section 6.6 seems less developed/focused than other sections. It isn't clear if the purpose of this section is to deal with ocean-based multi-decadal variability or movement of water between basins - but then it isn't so clear how movement of water between ocean basins is critical for a chapter on extremes and abrupt changes. There are important new studies on Pacific decadal variability and the links this has to megadrought and to modulating global temperatures (e.g the hiatus), but I wonder if they would be better covered in section 6.5, or by focusing 6.6 specifically on decadal-scale variability. Section 6.6 also lacks and overall assessment (with confidence language) of the status of knowledge in this area, and information about managing risks (e.g. issues with predictability of when IPO changes from positive to negative state until after the change has already happened). [Abram Nerilie, Australia]	take into account-text revised.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
2853	6	36	5	36	10	In this paragraph, two teleconnections between different ocean basins are demonstrated: 1) teleconnection from the Atlantic Ocean to the Pacific, and 2) teleconnection from the Indian Ocean to the Pacific. In particular, tropical Atlantic warming may drive a La Niña type change over the Pacific, heating the west Pacific warming, and cooling the east Pacific cooling, meanwhile intensifying the trade wind. Indian Ocean warming has similar impact on the tropical Pacific. Based on the description of this paragraph, the two teleconnections (Atlantic -> Pacific, and Indian Ocean -> Pacific) are not related to each other. However, recent studies find that the above two teleconnection are tightly linked to each other (Li et al, 2016, cited by the report). Atlantic waring will first heat the Indian Ocean through the wind-evaporation-SST effect. The Atlantic and Indian Ocean warming then drive the Pacific to a La Niña mode. On decadal time-scales, the three tropical ocean basins are tightly related to each other. The teleconnections between Atlantic and Pacific, and between the Indian Ocean and the Pacific are linked to each other. This relationship should be better demonstrated in the paragraph. [Xichen Li, China]	Take into account-text revised. Li et al., has been added
11507	6	36	9	36	10	Also Li et al. 2016: 10.1038/NCLIMATE2840 [Anson Cheung, United States of America]	accepted
8271	6	36	10	0		replace "are" with "is" [Nina Hunter, South Africa]	accepted
21231	6	36	10	36	23	It will be nice if the authors can include one or two lines to explain why the CMIP5 data in figure 6.7 isn't showing any variability as compared to the three re-analysis datasets i.e. CMIP5 results are from GCMs, why they can't simulate the natural internal variability which the other three datasets can. This would enable the non-technical readers, government officials and policay makers to understand the figure better. [APECS Group Review, Germany]	take into account-text/figure revised.
8273	6	36	11	0		replace "a" with "the" [Nina Hunter, South Africa]	accepted
8275	6	36	12	0		Change "unto" to "into" [Nina Hunter, South Africa]	accepted
11509	6	36	29	36	29	Also McGregor et al. 2018, doi: 10.1038/s41558-018-0163-4 [Anson Cheung, United States of America]	accepted
8277	6	36	38	0		Insert "a" after "On" [Nina Hunter, South Africa]	accepted
8279	6	37	1	0		Suggest insert "it" after colon [Nina Hunter, South Africa]	accepted
15183	6	37	1	37	2	The effect on the ITF during winter monsoon should be specified. Which type of monsoon enhances or reduces the ITF? [Alessandro Pezzoli, Italy]	take into account-text revised.
8281	6	37	2	0		Insert "a" before "lack" [Nina Hunter, South Africa]	accepted
8283	6	37	5	0		Insert comma before "1992" [Nina Hunter, South Africa]	accepted
8285	6	37	9	0		Insert "the" before "western" [Nina Hunter, South Africa]	accepted

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22585	6	37	15	37	21	Suggest revisiting the conclusions in this statement. Although IOD may affect the ITF transport on short time scales, on centennial time scale, the ITF variability is more likely to be associated with the Pacific, and the deep upwelling reduction has been identified as a key source of ITF transport reduction under the global warming (Feng et al. 2017 Contribution of the deep ocean to the centennial changes of the Indonesian Throughflow, Geophys. Res. Lett., 44, doi:10.1002/2017GL072577). [Government of Australia, Australia]	take into account-text revised. Feng et al., has been added
8287	6	37	16	0		Suggest remove "by" [Nina Hunter, South Africa]	accepted
8289	6	37	24	0		Suggest remove "to" [Nina Hunter, South Africa]	accepted
17405	6	37	38	37	55	The previous comment applies here. [Louis Lubango, Ethiopia]	accepted
22329	6	37	38	37	55	This section should include information on the large amount of post-AR5 literature identifying a link between decadal-scale variability in the Pacific and megadroughts (particularly in the US and Australia), including paleoclimate evidence, historical links and future projections. [Abram Nerilie, Australia]	accepted, a paragraph with some references has been added.
14643	6	37	40	37	41	We suggest revising the following sentence (Also during the 2000s, the global ocean carbon sink has strengthened again) as follows: "During the 2000s, the global ocean carbon sink has also strengthened". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	accepted
14645	6	37	44	37	45	The following paragraph fails to provide a strong enough logical and/or causal link between the first and second sentence:"A dominant fraction of decadal variability in the North Pacific nutrient, chlorophyll and zooplankton taxa can be explained by the North Pacific Gyre Oscillation (NPGO) and/or Pacific Decadal Oscillation (PDO) (Di Lorenzo et al., 2013). Therefore, the hiatus may have had significant impacts on marine organisms and ecosystems, but literature is scarce". We suggest that a further explanation of how the NPGO or PDO relate to the warming hiatus is provided. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - Sentence modified.
8291	6	37	48	0		Change 'decreased' to 'decreasing' [Nina Hunter, South Africa]	accepted
14647	6	37	52	37	55	We suggest revising the following sentence as follows: "This circulation system is believed to be a key tipping point of the Earth's climate system". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we assume this was referring to page 6-38, l. 11-12. We have revised the sentence accordingly.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1777	6	38	0	43		Section 6.7 is generally lacking detail around decadal prediction and predictability of the AMOC, SPG and North Atlantic in general. There is a substantial amount of literature and work on this topic that has been overlooked but that is important both in terms of the scientific context and also practically, in terms of developing climate services and adaptation measures. A good starting point is the IPCC AR5 WG1 Chapter on "Near Term climate prediction", but there has been substantial advances in the ensuing years that should be included. [Mark Payne, Denmark]	Accepted - this has been improved
1783	6	38	0	43		<p>Section 6.7 is also lacking detail on the ecological effects of changes in the AMOC and particularly for the SPG, for which there is actually quite good knowledge, ranging all the way from planktonic species to fish, tuna, pilot whales and seabirds, amongst others, and includes changes in distribution, productivity, biography and phenology. Some key references are below - I would also be happy to contribute text on this matter if it was useful.</p> <p>* Hátún, H., Payne, M. R., Beaugrand, G., Reid, P. C., Sandø, A. B., Drange, H., ... Bloch, D. (2009). Large bio-geographical shifts in the north-eastern Atlantic Ocean: From the subpolar gyre, via plankton, to blue whiting and pilot whales. <i>Progress In Oceanography</i>, 80(3–4), 149–162. <a href="https://doi.org/10.1016/j.pocean.2009.03.001">https://doi.org/10.1016/j.pocean.2009.03.001</a></p> <p>* MacKenzie, B. R., Payne, M. R., Boje, J., Høyer, J. L., &amp; Siegstad, H. (2014). A cascade of warming impacts brings bluefin tuna to Greenland waters. <i>Global Change Biology</i>, 20(8), 2484–2491. <a href="https://doi.org/10.1111/gcb.12597">https://doi.org/10.1111/gcb.12597</a></p> <p>* Miesner, A. K., &amp; Payne, M. R. (2018). Oceanographic variability shapes the spawning distribution of blue whiting ( <i>Micromesistius poutassou</i> ). <i>Fisheries Oceanography</i>, 27(6), 623–638. <a href="https://doi.org/10.1111/fog.12382">https://doi.org/10.1111/fog.12382</a></p> <p>* Hátún, H., Payne, M. R., &amp; Jacobsen, J. A. (2009). The North Atlantic subpolar gyre regulates the spawning distribution of blue whiting (<i>Micromesistius poutassou</i>). <i>Canadian Journal of Fisheries and Aquatic Sciences</i>, 66(5), 759–770. <a href="https://doi.org/10.1139/F09-037">https://doi.org/10.1139/F09-037</a></p> <p>* Nye, J. A., Baker, M. R., Bell, R., Kenny, A., Kilbourne, K. H., Friedland, K. D., ... Wood, R. (2014). Ecosystem effects of the Atlantic Multidecadal Oscillation. <i>Journal of Marine Systems</i>, 133, 103–116. <a href="https://doi.org/10.1016/j.jmarsys.2013.02.006">https://doi.org/10.1016/j.jmarsys.2013.02.006</a></p> <p>* Alheit, J., Licandro, P., Coombs, S., Garcia, A., Giráldez, A., Santamaría, M. T. G., ... Santamaría, G. (2014). Atlantic Multidecadal Oscillation (AMO) modulates dynamics of small pelagic fishes and ecosystem regime shifts in the eastern North and Central Atlantic. <i>Journal of Marine Systems</i>, 131, 21–35. <a href="https://doi.org/10.1016/j.jmarsys.2013.11.002">https://doi.org/10.1016/j.jmarsys.2013.11.002</a></p> <p>* Trenkel, V. M., Huse, G., MacKenzie, B. R., Alvarez, P., Arrizabalaga, H., Castonguay, M., ... Speirs, D. C. (2014). Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts. <i>Progress in Oceanography</i>. <a href="https://doi.org/10.1016/j.pocean.2014.04.030">https://doi.org/10.1016/j.pocean.2014.04.030</a> [Mark Payne, Denmark]</p>	Accepted - this has been improved

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15863	6	38	0	43		Section 6.7 is generally lacking detail around decadal prediction and predictability of the AMOC, SPG and North Atlantic in general. There is a substantial amount of literature and work on this topic that has been overlooked but that is important both in terms of the scientific context and also practically, in terms of developing climate services and adaptation measures. A good starting point is the IPCC AR5 WG1 Chapter on "Near Term climate prediction", but there has been substantial advances in the ensuing years that should be included. [EUCE, Belgium]	See comment 1777
15865	6	38	0	43		<p>Section 6.7 is also lacking detail on the ecological effects of changes in the AMOC and particularly for the SPG, for which there is actually quite good knowledge, ranging all the way from planktonic species to fish, tuna, pilot whales and seabirds, amongst others, and includes changes in distribution, productivity, biography and phenology. Some key references are below:</p> <p>* Hátún, H., Payne, M. R., Beaugrand, G., Reid, P. C., Sandø, A. B., Drange, H., ... Bloch, D. (2009). Large bio-geographical shifts in the north-eastern Atlantic Ocean: From the subpolar gyre, via plankton, to blue whiting and pilot whales. <i>Progress In Oceanography</i>, 80(3–4), 149–162. <a href="https://doi.org/10.1016/j.pocean.2009.03.001">https://doi.org/10.1016/j.pocean.2009.03.001</a></p> <p>* MacKenzie, B. R., Payne, M. R., Boje, J., Høyer, J. L., &amp; Siegstad, H. (2014). A cascade of warming impacts brings bluefin tuna to Greenland waters. <i>Global Change Biology</i>, 20(8), 2484–2491. <a href="https://doi.org/10.1111/gcb.12597">https://doi.org/10.1111/gcb.12597</a></p> <p>* Miesner, A. K., &amp; Payne, M. R. (2018). Oceanographic variability shapes the spawning distribution of blue whiting ( <i>Micromesistius poutassou</i> ). <i>Fisheries Oceanography</i>, 27(6), 623–638. <a href="https://doi.org/10.1111/fog.12382">https://doi.org/10.1111/fog.12382</a></p> <p>* Hátún, H., Payne, M. R., &amp; Jacobsen, J. A. (2009). The North Atlantic subpolar gyre regulates the spawning distribution of blue whiting (<i>Micromesistius poutassou</i>). <i>Canadian Journal of Fisheries and Aquatic Sciences</i>, 66(5), 759–770. <a href="https://doi.org/10.1139/F09-037">https://doi.org/10.1139/F09-037</a></p> <p>* Nye, J. A., Baker, M. R., Bell, R., Kenny, A., Kilbourne, K. H., Friedland, K. D., ... Wood, R. (2014). Ecosystem effects of the Atlantic Multidecadal Oscillation. <i>Journal of Marine Systems</i>, 133, 103–116. <a href="https://doi.org/10.1016/j.jmarsys.2013.02.006">https://doi.org/10.1016/j.jmarsys.2013.02.006</a></p> <p>* Alheit, J., Licandro, P., Coombs, S., Garcia, A., Giráldez, A., Santamaría, M. T. G., ... Santamaría, G. (2014). Atlantic Multidecadal Oscillation (AMO) modulates dynamics of small pelagic fishes and ecosystem regime shifts in the eastern North and Central Atlantic. <i>Journal of Marine Systems</i>, 131, 21–35. <a href="https://doi.org/10.1016/j.jmarsys.2013.11.002">https://doi.org/10.1016/j.jmarsys.2013.11.002</a></p> <p>* Trenkel, V. M., Huse, G., MacKenzie, B. R., Alvarez, P., Arrizabalaga, H., Castonguay, M., ... Speirs, D. C. (2014). Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts. <i>Progress in Oceanography</i>. <a href="https://doi.org/10.1016/j.pocean.2014.04.030">https://doi.org/10.1016/j.pocean.2014.04.030</a> [EUCE, Belgium]</p>	See comment 1783



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9857	6	38	1	38	1	<p>The section does not cite Hansen et al. (2016), who investigate the impact of major ice melting from Greenland and/or Antarctica on ocean circulation and hence on temperature anomalies. Given the high level of uncertainties concerning the future behavior of ice sheets, especially under strong GHG emissions, their findings should be discussed.</p> <p>Hansen, J., Sato, M., Hearty, P., Ruedy, R., Kelley, M., Masson-Delmotte, V., ... &amp; Velicogna, I. (2016). Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 C global warming could be dangerous. <i>Atmospheric Chemistry and Physics</i>, 16(6), 3761-3812. [Government of France, France]</p>	Accepted - we have added a reference to this study in the impact section.
24205	6	38	1	41	10	<p>quite a bit of changing between timescales. Would it be possible to talk about all the paleo evidence for tipping points, then move to observations, and projections of tipping points. [Gerard McCarthy, Ireland]</p>	Rejected - the narrative and rationale of this subsection is not constructed in this linear timeframe, but is rather following some topics that different sources of information can feed. At this stage, we prefer to stick to this former approach.
25583	6	38	3	0		<p>There is some literature missing here:</p> <ol style="list-style-type: none"> <li>1. Sijp, W. P., England, M. H. &amp; Gregory, J. M. Precise Calculations of the Existence of Multiple AMOC Equilibria in Coupled Climate Models. Part I: Equilibrium States. <i>J. Clim.</i> 25, 282–298 (2012).</li> <li>2. Sijp, W. P., Gregory, J. M., Tailleux, R. &amp; Spence, P. The Key Role of the Western Boundary in Linking the AMOC Strength to the North–South Pressure Gradient. <i>J. Phys. Oceanogr.</i> 42, 628–643 (2012).</li> <li>3. Schleussner, C.-F., Levermann, A. &amp; Meinshausen, M. Probabilistic projections of the Atlantic overturning. <i>Clim. Change</i> 1–8 (2014). doi:10.1007/s10584-014-1265-2</li> </ol> <p>The assessment doesn't go beyond what has been provided in the AR5 despite the fact that the scientific literature has evolved substantially since then. The absence of any model evaluation with regard to their AMOC representation in general and salinity import/export at 30°S compared to observations is a major concern (as this is the defining parameter for AMOC stability). [Schleussner Carl-Friedrich, Germany]</p>	Accepted - we have added the reference no 3. The two first are very interesting but are not entirely into the scope of this assessment of the potential for an abrupt drop in the AMOC. Furthermore, we are strongly limited in space to depict these very theoretical results (even though they are very interesting). Concerning the last statement of this comment, we think that the model evaluation with regard to their AMOC representation in general and salinity import/export at 30° as already been done in Weaver et al. (2012) assessed in AR5. Nevertheless, we now further discuss this point and provide new references in this subsection.
31507	6	38	5	0		<p>check the AMOC assessment in the recently published IPCC special report on 1,5C of global warming, chp 3 section 3.3.7 [Hans-Otto Poertner and WGII TSU, Germany]</p>	Accepted - we check the assessment from SR15 and are in line with its statement.
24191	6	38	7	38	7	<p>“deep convection” is not the only driver of AMOC (in fact it is a disputed driver). Suggest a more general phrase “ Deep waters formed in the northern North Atlantic induce a large-scale...” [Gerard McCarthy, Ireland]</p>	Accepted - the text has been modified
1747	6	38	7	39	34	<p>What does the role of natural climate variability in the North Atlantic play in AMOC changes that we are currently seeing and that we have seen in the past? [Nora Richter, United States of America]</p>	Rejected - this is an interesting but very difficult question since reconstruction of the AMOC in the past is a very difficult task. Furthermore, it was not very clear to us what was the aim of this question.
14649	6	38	11	38	12	<p>We suggest revising the following sentence as follows: "The AMOC plays an important function in [del: is a key player for ] transporting excess heat and anthropogenic carbon from the surface to the deep ocean (Kostov et al., 2014; Romanou et al., 2017), and therefore in setting the pace of global warming(Marshall et al., 2014)". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]</p>	Accepted - the text has been modified

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8293	6	38	14	0		Change "improve" to "improving" [Nina Hunter, South Africa]	Accepted - the text has been modified
24193	6	38	16	38	16	There are 6 dedicated AMOC observing systems: RAPID at 26°N, OSNAP in the subpolar NA, the Greenland-Scotland Ridge array, the NOAC array at 47°N, MOVE at 16°N, TSAA at 11°S, and SAMBA at 35°S. [Gerard McCarthy, Ireland]	Rejected - Due to space limitations we cannot cite all the observation systems. Thus, we cannot be here very exhaustive but only provide a few examples of observing systems and the associated estimates for the longest ones.
24195	6	38	16	38	16	A reference should be provided to 16°N lead by Uwe Send. [Gerard McCarthy, Ireland]	Accepted - the reference has been added.
9859	6	38	17	38	18	Correct : it should be at 34.5°S (Meinen et al. 2018). [Government of France, France]	Accepted - the text has been modified.
8295	6	38	20	0		Insert hyphen after "intra" to indicate that it is actually "intraannual" [Nina Hunter, South Africa]	Accepted - the text has been modified
24197	6	38	20	38	26	if all the systems are referenced, then all the values for AMOC should be quoted. They currently are not. [Gerard McCarthy, Ireland]	Rejected - Due to space limitation, we cannot be entirely exhaustive, and we thus decide not to cite all existing observation systems, and thus do not quote all estimates.
34063	6	38	21	39	26	The lack of meridional coherence in AMOC strength on interannual and decadal time scales should be mentioned for context. See references below: From Li et al., 2017: ""However, there has been no conclusive observational evidence for a linkage between changes in deep-water formation and AMOC variability over the modern observational record (Lozier 2012, and references therein). Also, ""Moreover, it has been shown that AMOC changes lack latitudinal coherence on interannual (Bingham et al. 2007; Zhang 2010) and decadal time scales (Lozier et al. 2010), such that AMOC changes at are unlikely to reflect AMOC changes in the subpolar North Atlantic on those time scales."" Li, F., Lozier, M. S., & Johns, W. E. (2017). Calculating the meridional volume, heat, and freshwater transports from an observing system in the subpolar North Atlantic: Observing system simulation experiment. <i>Journal of Atmospheric and Oceanic Technology</i> , 34(7), 1483-1500. [Government of United States of America, United States of America]	Rejected - We have a strong constraints in terms of space and since the topic of the chapter concerns abrupt changes and that we tackle here mainly such a risk for the AMOC system, we believe that these recent findings, even though there are very interesting and useful to broaden our knowledge concerning the AMOC dynamics, are a bit out of the scope of the present subsection. We thus decide that we cannot include it.
24297	6	38	22	38	23	It would be useful to add that the strong decrease of the AMOC observed during the winter 2009-2010 was due both to an anomalously negative Ekman transport due to a highly negative NAO and to a strengthening of the geostrophic flow. The paper showing this (McCarthy et al. 2012) is already cited. [Rym MSADEK, France]	Rejected - due to space limitation, we have had to reduce this paragraph, and we were thus not able to enter into this level of detail.
9861	6	38	25	38	25	The correct value is $14.7 \pm 8.3 \cdot 10^6 \text{ m}^3 \text{ s}^{-1}$ , correct citation is Meinen et al. 2018 [Government of France, France]	Accepted - the text has been modified
12871	6	38	33	38	39	There are other studies showing a decline of the AMOC since the mid 20th Century (Bryden et al., 2005 and Kanzow et al., 2006) and even the increase of 1 Sv between 1970-2000s shown by Latif et al. (2005) is in agreement with the temperature evolution reconstructed from SST data by Caesar et al. (2018). The latter have been (!) verified against observational data (Smeed et al., 2014) as well as an ocean reanalysis product (Jackson et al., 2015) and a reconstruction from satellite altimetry and cable measurements (Fraijka-Williams et al., 2015). Therefore I believe it to be very likely that the reconstructed AMOC weakening is real. [Levke Caesar, Germany]	Accepted - we have modified this paragraph to better state existing evidences for the weakening. Nevertheless, we do not include references older than 2013, since this report focus on novelties since AR5.

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12873	6	38	33	38	39	Regarding the paleo proxies: There are more studies that come to the same conclusion as Thornalley et al.2018, namely that the AMOC is very likely at its weakest state since far longer than 1000 years (e.g. Rahmstorf et al., 2015), thus I would be more confident here. Furthermore the weakening in Thornalley et al. (2018) happens mainly after the begin of the industrial revolution, i.e. since the beginning of larger emissions of CO2. The corresponding surface warming can trigger an AMOC slow down. [Levke Caesar, Germany]	Accepted - we have added the reference to Rahmstorf et al. (2015).
22331	6	38	33	38	39	The Rahmstorf reconstruction is also relevant here. Although the Ramstorf work has been controversial, the Thornalley work provides an independent reconstruction that supports the unusual weakening of the AMOC during the historical period that was reconstructed by Rahmstorf et al.,. The paleoevidence for recent AMOC changes is a significant new development since AR5. [Abram Nerilie, Australia]	Accepted - we have added the reference to Rahmstorf et al. (2015).
25589	6	38	33	38	39	I am very concerned that the current draft covers the important issue of a long-term anthropogenic AMOC decline only very briefly and superficially and the statements are sometimes outright incorrect. This is an important area needing improvement, where clearly more work by the lead authors is required to fully read and assess the scientific literature. [Stefan Rahmstorf, Germany]	Accepted - we have modified this paragraph to better state existing evidences for the weakening.
25591	6	38	33	38	39	Regarding the long-term AMOC decline, a discussion of the various lines of evidence is lacking. Only two recent studies are mentioned and quickly dismissed as not being validated by instrumental AMOC observations. This is untrue – while only very limited instrumental AMOC observations are available (I would include here e.g. Bryden’s data points as seasonally adjusted by Kanzow et al. 2010, even though those are geostrophic current calculations), the various proxy reconstructions are consistent with those. [Stefan Rahmstorf, Germany]	Accepted - we have modified the paragraph following most of the suggestions. We do not include Bryden data point, since given that Kanzow et al (2010) stated that "If we subtract the seasonal anomalies (...) the resulting “de-seasoned” time series of AMOC (...) does not show a persistent decline." Indeed, their Fig. 16 show that with so few points it is not possible to make any strong statistical statement.". We assess that this statement reflect the level of knowledge concerning the potential on-going AMOC weakening which is an emerging topic and deserves more analysis and use of detection-attribution framework.
25593	6	38	33	38	39	IPCC would not be doing its assessment job if it simply claimed: because we don't have long-term direct current measurements we can't say anything. IPCC needs to properly assess the various lines of evidence, and we have quite a number – often fully independent – proxy series here. These include at least: [Stefan Rahmstorf, Germany]	Accepted - we have clarified our statement.
25595	6	38	33	38	39	Dima, M. and G. Lohmann (2010). "Evidence for Two Distinct Modes of Large-Scale Ocean Circulation Changes over the Last Century." Journal of Climate 23(1): 5-16.  "The conveyor has been slowing down over the last seven decades" – based on a global SST pattern analysis, including strong anti-correlation between the North and South Atlantic patterns. [Stefan Rahmstorf, Germany]	Accepted - this reference has been added

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25597	6	38	33	38	39	<p>Sherwood, O. A., et al. (2011). "Nutrient regime shift in the western North Atlantic indicated by compound-specific delta15N of deep-sea gorgonian corals." Proc Natl Acad Sci U S A 108(3): 1011-1015.</p> <p>A continuous time series starting from 1925 but a few coral data points going back as much as 1800 years. The linkage of this water mass change to AMOC changes is demonstrated by simulations with the high-resolution GFDL coupled model (Saba et al. 2015) "We conclude that the persistence of the warm, nutrient-rich regime since the early 1970s is largely unique in the context of the last approximately 1,800 yr." [Stefan Rahmstorf, Germany]</p>	Accepted - this reference has been added
25599	6	38	33	38	39	<p>Rahmstorf, S., et al. (2015). "Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation." Nature Climate Change 5(5): 475-480.</p> <p>Two AMOC reconstructions in high agreement, based on</p> <p>(a) The instrumental global surface temperatures GISTEMP</p> <p>(b) The Mann et al. land-based proxy reconstruction</p> <p>The latter goes back 1100 years. "The AMOC weakness after 1975 is an unprecedented event in the past millennium (p&gt;0.99)." [Stefan Rahmstorf, Germany]</p>	Accepted - this reference has been added
25601	6	38	33	38	39	<p>Caesar, L., et al. (2018). "Observed fingerprint of a weakening Atlantic Ocean overturning circulation." Nature 556(7700): 191-196.</p> <p>Analysis of all available SST data sets to reveal a characteristic cold/warm fingerprint pattern also found in high-resolution global climate model data as a result of AMOC weakening. [Stefan Rahmstorf, Germany]</p>	Rejected - this reference was already cited.
25603	6	38	33	38	39	<p>„We provide evidence for a weakening of the AMOC by about 3 +/- 1 sverdrups (around 15 per cent) since the mid-twentieth century. This weakening is revealed by a characteristic spatial and seasonal sea-surface temperature 'fingerprint'-consisting of a pattern of cooling in the subpolar Atlantic Ocean and warming in the Gulf Stream region-and is calibrated through an ensemble of model simulations from the CMIP5 project. We find this fingerprint both in a high-resolution climate model in response to increasing atmospheric carbon dioxide concentrations, and in the temperature trends observed since the late nineteenth century." [Stefan Rahmstorf, Germany]</p>	Rejected - we already mention the main result of this study. Nevertheless, due to space limitation, we cannot provide too much details about this study in this report.

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25605	6	38	33	38	39	<p>Thornalley, D. J. R., et al. (2018). "Anomalously weak Labrador Sea convection and Atlantic overturning during the past 150 years." <i>Nature</i> 556(7700): 227-230.</p> <p>Two marine proxy data series:</p> <p>(a) Large-scale north Atlantic subsurface temperatures</p> <p>(b) Two locations of sortable silt, linked to local current speed.</p> <p>Both show weak modern AMOC unprecedented in at least 1500 years. Series (a) shows close agreement in time evolution with Rahmstorf et al. 2015 and Thibodeau et al. 2018. [Stefan Rahmstorf, Germany]</p>	Rejected - this reference was already cited.
25607	6	38	33	38	39	<p>Thibodeau, B., et al. (2018). "Last Century Warming Over the Canadian Atlantic Shelves Linked to Weak Atlantic Meridional Overturning Circulation." <i>Geophysical Research Letters</i> 45(22): 12,376-312,385.</p> <p>Another set of proxy data, independent of those of Sherwood et al., Rahmstorf et al., and Thornalley et al. but showing the same thing. "We used geochemical evidence to highlight a slowdown in the North Atlantic Ocean circulation over the last century. This change appears to be unique over the last 1,500 years." [Stefan Rahmstorf, Germany]</p>	Accepted - this reference has been added
25609	6	38	33	38	39	<p>Note also that all these papers show a highly consistent time evolution of the AMOC over the 20th Century, whether based on proxy data or instrumental temperatures, and consistent also with the slowdown measured by the RAPID project as well as other measurements (see Figs. 3 and 4 here: <a href="http://www.realclimate.org/index.php/archives/2018/05/if-you-doubt-that-the-amoc-has-weakened-read-this/">http://www.realclimate.org/index.php/archives/2018/05/if-you-doubt-that-the-amoc-has-weakened-read-this/</a>). I would urge you to read this article as well as this second one: <a href="http://www.realclimate.org/index.php/archives/2018/04/stronger-evidence-for-a-weaker-atlantic-overturning-circulation/">http://www.realclimate.org/index.php/archives/2018/04/stronger-evidence-for-a-weaker-atlantic-overturning-circulation/</a> which mentions a range of further studies that should be assessed by IPCC. [Stefan Rahmstorf, Germany]</p>	Accepted - we have revised the whole paragraph and now state that the AMOC has likely weakened over the historical era.
25611	6	38	33	38	39	<p>Additional evidence that corroborates an AMOC weakening concerns the weakening of deep ocean convection in the North Atlantic – I can't give a proper overview of this here but will mention at least three highly relevant studies:</p> <p>Moore, G. W. K., et al. (2015). "Decreasing intensity of open-ocean convection in the Greenland and Iceland seas." <i>Nature Climate Change</i> 5(9): 877-882.</p> <p>Sévellec, F., et al. (2017). "Arctic sea-ice decline weakens the Atlantic Meridional Overturning Circulation." <i>Nature Climate Change</i> 7(8): 604-610.</p> <p>Oltmanns, M., et al. (2018). "Increased risk of a shutdown of ocean convection posed by warm North Atlantic summers." <i>Nature Climate Change</i> 8(4): 300-304. [Stefan Rahmstorf, Germany]</p>	Accepted - we have added these key references.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25613	6	38	33	38	39	The way I understand the assessment task of IPCC is to assess and summarize all these studies and to show a summary graph compiling the different reconstructions from the peer-reviewed literature, similar to Fig. 3 in the first-mentioned blog. Note that this preceded the Thibodeau et al. paper so their curves should be added. We would be very happy to provide such an overview diagram! [Stefan Rahmstorf, Germany]	Rejected - we warmly thank Stefan Rahmstorf for this nice offer. Nevertheless, at this stage, the space is very constrained, and since our chapter is already around 30% too large, we cannot further enlarge it with a long discussion on this topic. This is simply coming too late. I am sure that next reports will be able to provide a proper view of this text, potentially with further evidences to strengthen knowledge on this topic and provide a more quantified estimate of likelihood.
25615	6	38	33	38	39	Importantly, the cooling of the subpolar Atlantic was predicted by climate models, and as we showed in Caesar et al. 2018 in Fig. 5, the observed cooling just corresponds to the median cooling predicted in the historic runs of the CMIP5 models. In the models we know this cooling is due to an AMOC decline. I do not understand the claim in the draft that we do not know the mechanisms for the climatic AMOC weakening. Global warming increases buoyancy in the deep water formation regions by warming and/or freshening the surface waters – the relative contributions depending on location. Where SST has cooled, freshwater input is dominant. There is a host of publications detailing these mechanisms. [Stefan Rahmstorf, Germany]	Accepted - In the first version of the report, this sentence was meaning that the exact processes are not attributed. Indeed, the decrease in convection can be linked to surface temperature warming or salinity decrease, which could be associated with increase in river runoff or precipitation, or glacial melting. On this aspect, it is still far from clear which exact process may explain the weakening found in Caesar et al. (2018) and Rahmstorf et al. (2015). For instance, Rahmstorf et al. (2015) suggested the weakening may be mainly due to glacial melting notably from Greenland ice sheet. This is still far from clear in the literature. We have modified this sentence to better explain what were meant here.
25617	6	38	33	38	39	Finally, there is no other plausible explanation for the subpolar cooling, as I detail in the first Realclimate article linked above.  My overall conclusion is that “it is very likely that the AMOC has declined since the early-mid 20th Century, as predicted by climate models, and is at its weakest in recent decades since at least a millennium”. Given that so many independent lines of evidence support this conclusion, but that no direct measurements exist, I would give this “medium confidence”. (In particular in relation to the list of impacts given in the SPM point B7.1, which in my view are less supported than the past and ongoing slowdown, but are given “medium confidence”.) [Stefan Rahmstorf, Germany]	Rejected - in SR15, it was stated that the AMOC has more likely than not weakened since the early-mid 20th Century. In this report, based on the new assessment that CMIP5 model do show a 1.4 Sv weakening over the recent decades. Nevertheless, we believe that we need more quantified study with detection-attribution framework to reach a higher level of likelihood. Furthermore, we need to have high confidence to have such a high level of likelihood.
1741	6	38	36	38	39	Paleoclimate records from past warm periods could be used as a reference for when the AMOC weakened in the past and whether we can expect to see that in the near future, this could be referenced and included here for more context. [Nora Richter, United States of America]	Accepted - We have added a sentence at the beginning of the paragraph to provide context and a few references (Govin et al. 2012 and Galaasen et al. 2014)
8297	6	38	37	0		Change "remain" to plural [Nina Hunter, South Africa]	Accepted - the text has been modified
23301	6	38	38	38	39	To be reflected in ES and SPM [Valerie Masson-Delmotte, France]	Accepted - this topic is now discussed in the ES and SPM
8299	6	38	39	0		Over the historical what? Period? Please insert some additional word for clarity. [Nina Hunter, South Africa]	Accepted - the text has been modified

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11289	6	38	41	38	46	See my comment above on the assessment of an AMOC collapse (page 4). Again, text from the FOD has been removed that should have been kept in this assessment, giving a more detailed view on this issue. You now simply go back to the AR5 assessment, disregarding new information. [Sybren Drijfhout, Netherlands]	Rejected - we do not believe that the new information is sufficient to strongly decrease this assessment. Indeed, even when considering the few models that do show a collapse of the AMOC in CMIP5, the likelihood remains below 90%. Also these two models have been estimated as weakly reliable in Sgubin et al. (2017). Also the literature stating that the AMOC may be less stable than expected from CMIP5 do not indicate that any collapse will be far faster (e.g. Liu et al. 2017). Here there is simply a question of time scale: a change of the AMOC takes time according to present-day climate models.
8301	6	38	42	0		Insert "the" before "Greenland" [Nina Hunter, South Africa]	Accepted - the text has been modified
34065	6	38	44	38	46	""Nonetheless, the CMIP5 models agree that a weakening of the AMOC into the 21st century will lead to localised cooling (relative to the global mean) in the northern North Atlantic, although the precise location is uncertain (Menary and Wood, 2018)."" In the earlier paragraphs, the AMOC is correctly described as transporting 'large amounts of heat northward'. In these lines the text says AMOC weakening will lead to 'localized' cooling. The spatial extent of this 'localized' cooling should be described better given that the spatial extent of northern hemisphere atmospheric warming associated with meridional ocean heat transport is small relative to the global scale but large relative to the European continent. Localized cooling could refer to a small patch in the N. Atlantic or across the entire western Europe. [Government of United States of America, United States of America]	Accepted - we have rephrased this sentence to make it clearer. The cooling is very model dependent, but generally speaking, it is centered around the subpolar gyre. Its extension depends on the model, but usually hardly cools Europe (cf. Sgubin et al. 2017). We have made this point clearer.
1743	6	38	48	38	56	What changes in our current climate system could cause the SPG to cross it's tipping point? Elaborate on the points mentioned here to make this clearer. [Nora Richter, United States of America]	Accepted - We have added a sentence at the end of the next paragraph to explain why a threshold can be crossed in projections.
8303	6	38	50	0		Suggest change "It is found" to "Results show" as "found" already used in previous sentence. [Nina Hunter, South Africa]	Accepted - the text has been modified
34067	6	38	52	38	52	Not sure what is meant by 'vertical heat export'. Perhaps 'vertical heat transport'? [Government of United States of America, United States of America]	Accepted - the text has been modified
24199	6	38	52	38	53	the Sgubin et al. mechanism is not AMOC. Should this section reflect in its title and introduction that there is more than AMOC discussed? [Gerard McCarthy, Ireland]	Accepted - We have modified the title of 6.7.1.1 and replace "AMOC weakening" by "Atlantic Ocean circulation changes"
24299	6	38	55	38	55	A recent study by Lique and Thomas (Nature Climate Change 2018) also shows that the regions of deep water formation could be shifted northwards toward the Arctic under strong warming. I suggest adding this reference here. [Rym MSADEK, France]	Accepted - this reference has been added.

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34069	6	38	55	38	56	""The poor representation of ocean deep convection in most CMIP5 models has been confirmed in Heuze (2017), highlighting a low confidence in the projections of its fate."" Suggest that the text mention that the reason for the poor representation of ocean deep convection in CMIP5 models is because CMIP5 class models have horizontal spatial resolutions that are too coarse to resolve ocean restratification following wintertime deep convection. In addition, somewhere in this section, it would be a good to mention that to adequately simulate future vertical heat transport, ocean stratification, and sub-Arctic sea ice extent for the purpose of climate projection the community must move to using ocean models with much higher horizontal resolution, allowing the explicit resolution of ocean restratification by mesoscale eddies. [Government of United States of America, United States of America]	Accepted - higher resolution can clearly contribute to improve the representation of convection, although this is not necessarily resolving all the issues. We have mentioned such an outlook here.
8305	6	38	56	0		Please rephrase "highlighting a low confidence in the projections of its fate" so that meaning is clear [Nina Hunter, South Africa]	Accepted - this has been rephrased to clarify the meaning.
1771	6	39	1	0		Figure 6.8 needs some work - in particular, the observational time series is almost invisible against the spread of other lines. Maybe a visualisation like Figure 6.7 would work better? [Mark Payne, Denmark]	Accepted - we have entirely changed this figure to improve readability
15867	6	39	1	0		Figure 6.8 needs some work - in particular, the observational time series is almost invisible against the spread of other lines. Maybe a visualisation like Figure 6.7 would work better? [EUCE, Belgium]	Accepted - the figure has been improved in terms of readability.
25581	6	39	1	0		There is some literature on SPG stability missing here. This literature also indicates that the SPG tipping point might have already been crossed. 1. Schleussner, C. F. & Feulner, G. A volcanically triggered regime shift in the subpolar North Atlantic Ocean as a possible origin of the Little Ice Age. <i>Clim. Past</i> 9, 1321–1330 (2013). 2. Schleussner, C.-F., Divine, D., Donges, J. F., Miettinen, A. & Donner, R. V. Evidence for a non-linear regime shift in the North Atlantic ocean circulation at the onset of the Little Ice Age. <i>Clim. Dyn.</i> 16, 4268 (2015). 3. Mengel, M., Levermann, A., Schleussner, C.-F. & Born, A. Enhanced Atlantic subpolar gyre variability through baroclinic threshold in a coarse resolution model. <i>Earth Syst. Dyn.</i> ... 3, 189–197 (2012). [Schleussner Carl-Friedrich, Germany]	Accepted - we have cited these three useful references.
24201	6	39	1	39	1	"the SPG system"—can you be more specific? It's not clear if this refers to circulation, convection, or another mechanism. [Gerard McCarthy, Ireland]	Accepted - we use the term "system" to avoid to refer to a specific mechanism, but rather include all the processes affecting the SPG, that is defined here as a dynamical system. We have added dynamical system to clarify this point.



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
34073	6	39	1	39	34	In the introduction to the chapter, specifically page 4 lines 29-33, the SPG is described as a 'tipping element': ""A new tipping element, the Subpolar Gyre System (SPG) in the North Atlantic, has been identified in some climate models (medium confidence). It involves an abrupt cooling of the North Atlantic SPG on a shorter, decadal time scale than the AMOC decline, but with smaller potential climate impacts."" And later described as a 'tipping point': ""The SPG system has been identified as a tipping point (Born et al., 2013), meaning that this circulation can change very abruptly between different stable steady states, due to positive feedback between convective activity and salinity transport within the gyre (Born et al., 2016). It has been argued that a transition between two SPG stable states can explain the onset of the Little Ice Age that may have occurred around the 14-15th century (Lehner et al., 2013; Moreno-Chamarro et al., 2017), while a few CMIP5 climate models showed a rapid cooling in the SPG within the 1970s cooling events, as a non-linear response to aerosols (Bellucci et al., 2017). The SPG therefore appears as a tipping element in the climate system, with a faster (decade) response than the AMOC (century), but with lower induced SST cooling."" The text says the SPG can transition from a state where it transports freshwater from the upper ocean to depth via vertical convection before it is exported at depth via lateral advection to a state where the vertical transport of freshwater is arrested. Because heat is transported up as freshwater is transported down (at least in today's climate), the reduction of vertical mixing would lead to a reduction of SPG SSTs. That makes sense and, in fact, is a classic result found in so-called 'hosing experiments'. The accumulation of freshwater at the surface also allows for the anomalous southward expansion of sea-ice in winter which can shift the storm track and further reduce heat exchange from the ocean the atmosphere. The text also says that 'a few CMIP5' models showed a rapid cooling [...] in the 1970s [...] as a non-linear response to aerosols. Given that CMPI5 models cannot adequately resolve vertical mixing to begin with and the fact that these models do not show SPG shutdown in warming scenarios, this chapter's discussion of SPG shutdown in the context of climate projections is not sufficient in its current form. Strangely, the later discussion about Greenland freshwater input as a potential factor in weakening Labrador Sea convection does not link back to the SPG discussion. [Government of United States of America, United States of America]	Accepted - we have improved our description of the SPG tipping element and the fact that it can cross a tipping point with a few more details. Nevertheless, due to space limitation it is difficult to enter to much into the details here. We also referred back to the SPG when discussing the potential decline of convection in the Labrador Sea later on in this subsection.
34071	6	39	1	39	8	The discussion about Greenland melt should include a reference to the recently published reconstruction of melt intensity from the 18th century to present day from from Trusel and co-authors. An excerpt: ""Our results show a pronounced 250% to 575% increase in melt intensity over the last 20 years, relative to a pre-industrial baseline period (eighteenth century) for cores NU and CWG, respectively (Fig. 2). Furthermore, the most recent decade contained in the cores (2004-2013) experienced a more sustained and greater magnitude of melt than any other 10-year period in the ice-core records."" Trusel, L. D., Das, S. B., Osman, M. B., Evans, M. J., Smith, B. E., Fettweis, X., et al. (2018). Nonlinear rise in Greenland runoff in response to post-industrial Arctic warming. Nature, 564(7734), 104-108. <a href="https://doi.org/10.1038/s41586-018-0752-4">https://doi.org/10.1038/s41586-018-0752-4</a> [Government of United States of America, United States of America]	Accepted - this reference has been added in the subsection concerning Greenland melting.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1745	6	39	3	39	5	What actual evidence is there to support this theory and what would mechanism drove the initial cooling that drove the SPG stable state across it's tipping point? And has this been proposed for any other periods of cooling in the paleoclimate record that would support this? [Nora Richter, United States of America]	Accepted - there are a few proxy records that indicate a rapid change in the North Atlantic ocean at this period. Some studies propose that the shift may be related with large volcanic eruption occuring earlier (e.g. Schlessner et al. 2013). We have slightly improved this paragraph, but cannot go into too much details due to space limitations. At least the key references supporting this hypothesis are more numerous now.
31745	6	39	10	0		Figure 6.8. The different lines here are not possible to track based on the legend. It might be better to select only a few key models or lines that are addressed in the caption and give a distinct color only to these ones - leave the rest as simple light gray lines and refer to them in the legend as a single collection of models. Alternatively, you could group them based on AR5 models and the rest, and as such, have only two types of color lines. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - the figure has been improved in terms of readability.
12947	6	39	10	39	11	The color code for the different models in Fig. 6.8 is impossible to read please consider only to plot the envelope of all models by shading and the ensemble mean [Government of Germany, Germany]	Accepted - the figure has been improved in terms of readability.
12949	6	39	10	39	11	The red thick line for the Rapid observations is impossible to find in the present form of Fig. 6.8, could be better if only the envelope of all models is plotted [Government of Germany, Germany]	Accepted - the figure has been improved in terms of readability.
23975	6	39	12	39	12	It is difficult to distinguish the thick red line (observed value) in Figure6.8. [Government of Japan, Japan]	Accepted - the figure has been improved in terms of readability.
24301	6	39	16	39	16	The caption says that in c) and d) "the time series show the percentage of changes with reference period taken as 2005-2015." I thing this is slightly incorrect as the values shown on the y-axis are not the percentage of change but the value relative to the period 2005-2015 *100. The percentage of change is inferred by taking 100 minus the value shown on the y-axis. I suggest changing in the caption "percentage of changes ..." by "AMOC strength relative to the value during 2005-2015" [Rym MSADEK, France]	Accepted - the caption has been corrected.
8307	6	39	21	0		Insert "the" before "CMIP5" [Nina Hunter, South Africa]	Accepted - this has been corrected
12875	6	39	22	39	24	It is said that one model shows an AMOC collapse before the end of the century but you don't say under which scenario. [Levke Caesar, Germany]	Accepted - this was for RCP8.5 scenario, we have specified this in the corrected version.
863	6	39	23	39	23	Please list the 'one model' in the tex since I can't tell which it is from the figure [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this model is FGOALS-s2. This is now specified.
22333	6	39	24	39	26	Consistency of time intervals: the end-of-century interval being adopted in SROCCis 2081-2100. Is it possible to give these quantified values for this standardised time interval? [Abram Nerilie, Australia]	Accepted - this has been corrected.
22335	6	39	24	39	26	This quantified information could be suitable for inclusion in SPM Figure 1 [Abram Nerilie, Australia]	Accepted - to be discuss with CLA...
8309	6	39	25	0		Insert "with" after "compared" [Nina Hunter, South Africa]	Rejected - we replaced as compared by relative to. This was proposed by Governement of the UK.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14651	6	39	25	39	26	What method was used to come up with these ranges? Is it just the model range? Please specify this here. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - This range was based on CMIP5 models as stated before. We clarified this.
14653	6	39	25	39	26	I think 'as compared' should be 'relative to' [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this has been corrected
34075	6	39	36	39	36	The title of 6.7.1.2 is "Role of Greenland Ice Sheet Melting" but the text also refers to increased freshwater contributions from the Canadian Arctic Archipelago glaciers and sea-ice. Therefore the section name should reflect the fact that additional freshwater input into the N. Atlantic has multiple sources. The magnitudes of freshwater increase from three terms are comparable. [Government of United States of America, United States of America]	Accepted - we have modified this title.
12951	6	39	38	39	38	Since deep convection has resumed in the Labrador Sea after 2014 this sentence is no longer true and has to be rephrased. [Government of Germany, Germany]	Accepted - we specified that this reduction was until 2014
24203	6	39	38	39	38	Yashayaev and Loder, JGR Oceans, 2016, 121 cite strong deep convection in the Labrador Sea. [Gerard McCarthy, Ireland]	Accepted - we specified that this reduction was until 2013
34077	6	39	38	40	8	This reference does NOT find evidence for freshening: Dukhovskoy et al. (2016), JGR Oceans, 121(1), 877-907. [Government of United States of America, United States of America]	Accepted - we have added this reference at the end the paragraph when we insist on the large uncertainty that remains concerning the hypothesis of an impact of GrIS on present-day circulation.
8311	6	39	40	0		Insert "the" before "Greenland"; "Greenland ice sheet" abbreviated "GIS" in chapter 3, "GrIS" not consistent [Nina Hunter, South Africa]	Accepted - this has been corrected.
10097	6	40	1	40	2	For clarification regarding changes in ocean water masses, it should be important to say: "Over the same time period, there has been about a 50% decrease in the thickness of the dense water mass formed in the Labrador Sea, suggesting ..." [Elsa Arellano-Torres, Mexico]	Accepted - this has been corrected.
24377	6	40	1	40	3	The results from Yang on LSW thickness were for the period up to 2013. However in the 2013/14 winter there was an extreme heat loss in the subpolar gyre (Grist et al. 2016 - Climate Dynamics 10.1007/s00382-015-2819-3) and subsequent re-thickening of LSW (Yashayaev and Loder 2017 - GRL 10.1002/2016GL071668). This calls into question the tendencies that Yang was drawing on in their Fig 5 since the freshwater flux continues upwards, but the thickness which declined to 2013 would have increased again in the subsequent two winters. [Eleanor Frajka-Williams, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we clarified that this reference was true until 2013 and we mention that the convection resumed in 2014 to highlight caveats for the hypothesis of Yang et al. (2016)

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
865	6	40	5	40	5	I don't like the phrase 'emerging short-term impact'. Firstly its unclear on a quick read that this impact has not yet been seen. Also I don't understand why 'short-term' is used. If there is an ongoing increase in freshwater input then it would be an ongoing impact. I would change this to "emerging future impact" [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we replace by future for the AMOC.
867	6	40	6	40	7	The Boning results argue against this - to quote: "We conclude that the freshwater anomaly has not yet had a significant impact on the Atlantic meridional overturning circulation." [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - We have entirely rewritten this section to better highlight the considerable uncertainty that remains concerning this hypothesis.
28407	6	40	8	40	8	May be also mention box model study by Proshutinsky 2015 here: doi:10.1098/rsta.2014.0160 [Jonathan Bamber, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this reference has been added
1749	6	40	10	40	24	How do these triggers relate to the tipping points discussed in the previous section? [Nora Richter, United States of America]	Accepted - we have made a reference to tipping points when discussing the hysteresis behaviour of the AMOC in response to freshwater release.
869	6	40	21	40	21	Another reference for eddy-resolving hysteresis Jackson and Wood, 2018 <a href="https://doi.org/10.1029/2018GL078104">https://doi.org/10.1029/2018GL078104</a> [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this reference has been added
871	6	40	21	40	24	Also biases in salinity caused by the position of the ITCZ has been mentioned as being important for AMOC stability <a href="https://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-13-00264.1">https://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-13-00264.1</a> [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this reference has been added
14655	6	40	25	40	28	Figure 6.9 should also be cited on page 39, in the paragraph on projections (from line 21). [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Rejected - this figure is based on AMOCMIP which is only described in the subsequent section, which is why we do not refer t it in the paragraph you mention, which is only depicting CMIP5 results.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14657	6	40	25	40	28	Figure 6.9 is cited in the text regarding the impact of GRIS melting on the AMOC but this is not shown in the figure. Suggest you either choose a different figure from Bakker et al, or change the way this figure is cited. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we have modified the way we introduce this figure 6.9 to clarify the fact that this is not showing only the impact of GIS melting, but the total impact including this term.
14659	6	40	25	40	28	Figure 6.9 legend needs clearer explanation. What exactly is shown here. E.g. why does the Median line have an intercept of -10%, for 0 global warming? And why do we have anomalies as large as -40% at 0 global warming? I'm guessing that these results are annual anomalies (including internal variability). If so, And why do we have anomalies as large as -40% at 0 global warming? If so, then the figure caption is misleading ('changes in AMOC strength as a function of transient changes in global mean temperature'). [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - the way this figure has been constructed is depicted in the caption. It is only concerning projection under RCP4.5 and RCP8.5 scenario. The fact that we can find 40% decrease for the 0°C global warming is simply due to internal variability within this projection (both in global mean temperature and AMOC). We further clarified this important point within the caption.
873	6	40	26	40	26	In Fig 6.9 it seems odd that the range is so large with no global temperature change. Since what is shown are percentage changes, the spread can only come from internal variability but is very large. Since you're using only future RCP scenarios I'd also expect there to be no/little data around the 0 degree change - ie all the data from 2006 onwards should be warmer than the 1850-1900 period. [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - following a similar comment from government of the UK, we have tried to clarify this point in the caption. It is indeed related to the fact that we are only considering future projections under RCP4.5 and RCP8.5 scenario.
25585	6	40	28	0		Given the very rapid warming under RCP8.5 and the AMOC response time of several decades, a GMT - AMOC scaling is misleading. The issue is noted in the figure caption, but that is not sufficient in my view. This is in particularly true, since TCR is very different between the different GCMs, which means that the time-GMT scaling differs substantially between models. It is therefore suggested to replace this figure with a scenario dependent representation of future AMOC dynamics. [Schleussner Carl-Friedrich, Germany]	Rejected - it is difficult to make such a strong modification at this stage. We agree that the figure can be misleading in a sense if not sufficiently well-explained. We have tried to further improved the caption to clarify this point.
8313	6	40	35	0		Suggest insert range percentages between parentheses so that it reads better [Nina Hunter, South Africa]	Accepted - this has been corrected
12953	6	40	39	40	39	Fig. 6.9: It has to be "The vertical dashed green line...." and not "The horizontal dashed green line..." [Government of Germany, Germany]	Accepted - this has been corrected
12877	6	41	1	41	2	It would be easier to understand if you write ... blue cross stands for the observed redcution estimate... [Levke Caesar, Germany]	Accepted - this has been corrected
24303	6	41	5	41	9	Add a reference to Yeager et al. (2018). Using a large ensemble they show that the decrease of the AMOC in the coming decade is unlikely. [Rym MSADEK, France]	Accepted - this reference has been added
8315	6	41	7	0		Suggest remove "indicate" for ease of reading [Nina Hunter, South Africa]	Accepted - this has been corrected
24307	6	41	7	41	7	To strengthen the message I suggest adding to the list of references about decadal predictions the recent work by Yeager et al. (BAMS 2018) based on a large ensemble. [Rym MSADEK, France]	Rejected - this short paragraph is already supported by several references. Furthermore, due to space limitation, we cannot increase its size, as it may deserve if we add a large number of references.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
24305	6	41	8	41	8	I suggest adding next to "Smith et al. (2013) "the following more recent additional references that suggest a possible weakening of the AMOC in the coming decade using initialized prediction systems : Hermanson et al. 2014; Robson et al. 2014, 2016; Yeager et al. 2015 [Rym MSADEK, France]	Accepted - these references has been added.
8317	6	41	9	0		Insert "the" before "GrIS" [Nina Hunter, South Africa]	Accepted - this has been corrected
8319	6	41	13	0		Suggest replace "remains" with "is" [Nina Hunter, South Africa]	Accepted - this has been corrected
14661	6	41	13	41	17	It's worth mentioning here that there have been many more studies on AMOC impacts than SPG (latter more recently identified as issue of interest) [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this is now mentionned.
14663	6	41	15	41	17	Please include a reference for the sentence about SPG state change. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - we are now citing Sgubin et al. (2017) as an example.
34079	6	41	15	41	17	This claim has not be described in the chapter text or references: ""Furthermore, the SPG subsystem has been shown to potentially shift, in the future, into a cold state over a decadal time scale, with lower amplitude but still very significant climatic implications."" The later statement (line 45-47) that ""In summer, cold anomalies in the SPG, like the one occurring during the so-called cold blob ..."" is not justified by the speculations made in Josey et al., 2018. Also, the cold anomaly in the SPG was a result of extraordinary winter-time heat loss which likely led to deeper than normal convection, not because of an accumulation of surface freshwater (buoyancy) and a corresponding reduction of maximum convective depths -- the mechanism that is invoked earlier in the chapter to explain how anomalous low surface SSTs can develop in the SPG. [Government of United States of America, United States of America]	Accepted - this claim was indeed not sufficiently supported. We have now added a reference to Sgubin et al. (2017) that did show that a collapse of the SPG can strongly modulate the climatic change for Atlantic bordering region from Europe (cf. their Fig. 4). This sentence has been modified for clarity.
22337	6	41	26	41	26	AMV seems misplaced in section on AMOC. Maybe more appropriate for section 6.6, with other mutlidecadal variability such as IPO/PDO [Abram Nerilie, Australia]	Rejected - as mentionned, the AMV is here used as a potential fingerprint of AMOC changes in the past (large litterature supports in part this statement). It is in that sense that we discuss it here to help evaluating potential impact of AMOC variations using observations and not models.
10099	6	41	26	41	27	To avoid confusion it should read: "..., the so called Atlantic Multidecadal Variability (AMV), or Atlantic Meridional Oscillation (AMO), also provides...". The term AMO is better well-known by many people, although recently, the more general term AMV has been adopted by the community. [Elsa Arellano-Torres, Mexico]	Accepted - the text has been modified

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
1751	6	41	31	41	52	These direct impacts are very focused on Europe. What about the rest of the North Atlantic region? How will changes in the AMOC impact the east coast of North America and coastal Africa? [Nora Richter, United States of America]	Accepted - we are assessing existing literature, and there are far more dedicated to Europe. Nevertheless, in the new version, we have found some literature on the impact in some Mexico states and also in Canada (St-Lawrence estuary). This new reference may help to improve this bias.
10843	6	41	31	42	57	The impact of the changing of the Atlantic Meridional Overturning Circulation on the Mediterranean basin and North Africa region is not clearly illustrated. [khadija kadibi, Morocco]	Rejected - we have not found literature on this topic. Since we are only assessing literature, we cannot answer this request.
24311	6	41	33	41	33	I suggest adding here a reference to Peings et al. (JGR atmos 2016) who examined the winter atmospheric response to the AMV in CMIP5 models. They found that only 2 models were able to show a modulation of the NAO by decadal oceanic variability in the North Atlantic. This highlights the difficulty to find a consistent response of atmospheric dynamics to oceanic decadal changes and hence the low confidence of the results described in this section. A paper by O'Reilly et al. (J. Climate 2017) would also be useful to cite within this context as it highlights that AMV-induced surface air temperature and precipitation anomalies during winter are primarily controlled by circulation anomalies (e.g. the NAO) that remain difficult to predict on decadal time scales, which partly explain the discrepancies between the models responses to North Atlantic changes induced by the AMOC. [Rym MSADEK, France]	Accepted - we have added a reference to this study to insist on the fact that some uncertainties remain concerning this impact on the storm track.
24379	6	41	42	41	45	Recommend "The observed extreme low AMOC in 2009-2010, which was followed by a reduction in ocean heat content to the north (Cunningham et al., 2013)". The changes reflect that Cunningham et al focused on a cooling north of 26N following the 2009/10 low in the AMOC, not simultaneously. [Eleanor Frajka-Williams, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this has been corrected
8321	6	41	43	0		Suggest remove "suggested to be" for ease of reading [Nina Hunter, South Africa]	Accepted - we remove it, but replace it by "possibly" to insist on the uncertainty about this result.
8323	6	41	47	0		Suggest replace "on" with "with regard to" [Nina Hunter, South Africa]	Accepted - this has been corrected.
8325	6	41	48	0		Insert "the" before "lack" [Nina Hunter, South Africa]	Accepted - this has been corrected.
11575	6	41	56	41	56	I would delete the word 'up'. The new sentence would be: ' A collapse of the AMOC or of the SPG could induce substantial increase of sea-level up to a few tens of centimetres along the western boundary of the North Atlantic (Ezer et al., 2013; Little et al., 2017; cf. Chapter 5).' [Luca Castrucci, United States of America]	Accepted - this has been corrected.
22587	6	42	0	42	0	Suggest a more prominent discussion of impact outliers. Currently it is unclear from the corresponding text why there are significant impacts beyond the Atlantic. [Government of Australia, Australia]	Rejected - the figure 6.10 is indeed showing that most of impact concerns the regions bordering the Atlantic, but it is also affecting East Asian monsoon system and several elements of the Southern Ocean. Thus, we believe that the impacts can be qualified to be worldwide. There is also insights on the impact on Pacific variability.
23303	6	42	0	42		This figure should convey the level of scientific understanding or an assessment of confidence beyond the pictograms and arrows showing signs. [Valerie Masson-Delmotte, France]	Accepted - we have added an assessment of the confidence in the processes related with each impact.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
21227	6	42	7	42	11	Line 11 states that the potential for migration would increase. This statement contradicts with the decreasing trend for 'Migration pressure' (within the human systems category) shown in figure 6.10 [APECS Group Review, Germany]	Accepted - the arrow was related to the livelihoods and economics that may decrease inducing an increasing migration pressure. We have modified the arrow by "migration pressure due to decrease in livelihoods and economics.
8327	6	42	10	0		Change "crops" to singular [Nina Hunter, South Africa]	Accepted - this has been corrected
8329	6	42	18	0		Suggest change "impacts on population" to "population impacts" [Nina Hunter, South Africa]	Accepted - this has been corrected
8331	6	42	19	0		Change "a" to "the" [Nina Hunter, South Africa]	Accepted - this has been corrected
24309	6	42	20	42	21	I would be more precise here and say that a cool North Atlantic induces a warm Pacific in the tropics. Indeed, the Northern Hemisphere Pacific response to changes in the Atlantic is not uniform. Ruprich-Robert et al. (J. Climate 2017) showed that the response of the North Pacific to the AMV projects onto the Interdecadal Pacific Oscillation Pattern in winter. Indeed, a cooler North Atlantic (negative AMV) is associated with a warmer tropical Pacific and a positive PDO-like pattern in the North Pacific. I suggest describing both tropical and extratropical anomalies in the Pacific and adding a reference to Ruprich-Robert et al. (2017) in this section. [Rym MSADEK, France]	Accepted - this has been corrected
14665	6	42	23	42	28	Figure 6.10 implies that changes in the AMOC and in the SPG have similar impacts. This is not reflected in the text, where some but by no means all impacts are common. I suggest having two panels: one for AMOC, one for SPG [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - to simplify, we are now only showing impacts due to the AMOC and we do not depict impacts related with SPG collapse, for which very few literature exist up to now.
31747	6	42	24	0		Figure 6.10. Place the legend arrows together, and close to the rest of the legend. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - the figure has been modified
31749	6	42	24	0		Figure 6.10. The icons could be recolored in monochrome style, then you could define all the Physical icons in blue, all the biological icons in green, and all the human system icons in red - this way the map would tell a more clear story without too much distraction from the individual colored icons. [Hans-Otto Poertner and WGII TSU, Germany]	Accepted - the figure has been modified
875	6	42	24	42	24	I don't agree with the increased heat waves over Europe. I guess this is from the suggestion that the cold anomaly in the subpolar region led to increased heatwaves. However a substantial AMOC weakening is different from a limited region of cooling, and climate models show large cooling over Europe from a substantial AMOC weakening. [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - to avoid misunderstandings, we are now only showing impact of an AMOC substantial weakening and we remove this reference to heat waves.
3345	6	42	24	42	24	I've noticed that the impacts in this figure are supposedly for AMOC and SPG weakening. Although these would both cause cooling of the subpolar north Atlantic, the former would cause more widespread cooling. This has impacts on the tropics and southern hemisphere that I doubt have been seen from a subpolar gyre cooling. Hence it is very misleading to lump the two sets of impacts together. [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this figure is now only discussing impact of large AMOC changes related with decrease in convection and associated impacts.



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
21225	6	42	24	42	28	Livelihood, economics and migration pressure' teleconnection within the human systems category: I think migration should be added as a seprate teleconnection/impact beacause it react in a different way as comared to livelohood and economic situation. Figure 6.10 shows that droughts will increase in the Sahel region which will reduce the 'Agriculture and Food Production', and also 'Livelihood and Economic Situation'. However the 'Migration Pressure' would increase as people will tend to move to locations with better livelihood and economic security. 'Migration Pressure' is currently predicted to decrease as well in the figure, which in my understanding is wrong. [APECS Group Review, Germany]	Accepted - we have modified the caption to mainly insist on migration pressure.
8333	6	42	31	0		Change "for" to "in" [Nina Hunter, South Africa]	Rejected - the sentence has been modified differently.
14667	6	42	31	42	32	From reading the following sentence:"A large potential decline in the AMOC strength reduces global surface warming notonly due albedo changes, but also due to changes in the location of ocean heat uptake" it is not clear at all how a decline in the AMOC could affect albedo rates. This should be explained clearly and is possible an example should be provided. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted - the description of the impact of the AMOC on albedo has been improved.
14669	6	42	33	42	34	We suggest the revised punctuation for the following sentence:"Repeated extreme and compound events are leading to critical transitions in social systems (Kopp et al., 2016),which may cause the disruption of (local) communities, creating cascading impacts consisting of short-term impacts, as well as long-lasting economic effects, and in some cases migration". [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted, we changed the text accordingly
8335	6	42	34	0		Insert "to" before "albedo" [Nina Hunter, South Africa]	Rejected - the sentence has been modified differently.
23305	6	43	0	43		Decadal predictions addressed heterogeneously in report. Could ch 6 coordinate this across chapters (incl. Ch 2) and develop a narrative for SPM if this is to be reflected? [Valerie Masson-Delmotte, France]	As this was not included the the approved outline, we did not cover it
8337	6	43	5	0		Please define Heinrich events [Nina Hunter, South Africa]	Accepted - this has been corrected
8339	6	43	6	0		Change "with" to "to" [Nina Hunter, South Africa]	Accepted - this has been corrected
8341	6	43	8	0		Change "with" to "to"; change "area" to "areas" [Nina Hunter, South Africa]	Accepted - this has been corrected
1773	6	43	14	0		Further examples of distributions in this area driven by changes in the circulation / SPG include mesopelagic fish (Miesner and Payne 2018) and Bluefin Tuna (MacKenzie et al 2014) * Miesner, A. K., & Payne, M. R. (2018). Oceanographic variability shapes the spawning distribution of blue whiting ( <i>Micromesistius poutassou</i> ). Fisheries Oceanography, 27(6), 623–638. <a href="https://doi.org/10.1111/fog.12382">https://doi.org/10.1111/fog.12382</a> * MacKenzie, B. R., Payne, M. R., Boje, J., Høyer, J. L., & Siegstad, H. (2014). A cascade of warming impacts brings bluefin tuna to Greenland waters. Global Change Biology, 20(8), 2484–2491. <a href="https://doi.org/10.1111/gcb.12597">https://doi.org/10.1111/gcb.12597</a> [Mark Payne, Denmark]	Accepted - this has been corrected

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
15869	6	43	14	0		Further examples of distributions in this area driven by changes in the circulation / SPG include mesopelagic fish (Miesner and Payne 2018) and Bluefin Tuna (MacKenzie et al 2014) * Miesner, A. K., & Payne, M. R. (2018). Oceanographic variability shapes the spawning distribution of blue whiting ( <i>Micromesistius poutassou</i> ). Fisheries Oceanography, 27(6), 623–638. <a href="https://doi.org/10.1111/fog.12382">https://doi.org/10.1111/fog.12382</a> * MacKenzie, B. R., Payne, M. R., Boje, J., Høyer, J. L., & Siegstad, H. (2014). A cascade of warming impacts brings bluefin tuna to Greenland waters. Global Change Biology, 20(8), 2484–2491. <a href="https://doi.org/10.1111/gcb.12597">https://doi.org/10.1111/gcb.12597</a> [EUCE, Belgium]	Accepted - this has been corrected
10101	6	43	23	43	25	For clarification, the sentence should read: "For example, a collapse of the AMOC may induce causal interactions like changes in ENSO characteristics, dieback of the Amazon rainforest (AMAZ) and shribking of the West Antarctic Ice Sheet (WAIS) due to seesaw effect, ITCZ southern migration and large warming of the Southern Ocean." [Elsa Arellano-Torres, Mexico]	Accepted - this has been corrected
877	6	43	38	43	42	I think it is worth pointing out that early warning systems might be found in the future that do not depend on having a long time timeseries (or even on timeseries analysis). We do not currently have anything feasible, however this should be an important research goal [Laura Jackson, United Kingdom (of Great Britain and Northern Ireland)]	Accepted - this has been corrected
8343	6	43	44	0		Change "be also" to "also be" [Nina Hunter, South Africa]	Accepted - this has been corrected
8345	6	43	44	43	45	Suggest rephrase "The ... predictions": "The World Climate Research Programme's (WCRP) grand challenge of launching decadal predictions..." [Nina Hunter, South Africa]	Accepted - this has been corrected
1775	6	43	48	0		... and marine fisheries (Payne et al. 2018) Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. Frontiers in Marine Science, 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [Mark Payne, Denmark]	Accepted - this has been corrected
15871	6	43	48	0		... and marine fisheries (Payne et al. 2018) Payne, M. R., Hobday, A. J., MacKenzie, B. R., Tommasi, D., Dempsey, D. P., Fässler, S. M. M., ... Villarino, E. (2017). Lessons from the First Generation of Marine Ecological Forecast Products. Frontiers in Marine Science, 4. <a href="https://doi.org/10.3389/fmars.2017.00289">https://doi.org/10.3389/fmars.2017.00289</a> [EUCE, Belgium]	Accepted - this has been corrected
23423	6	43	51	44	7	Risk causes impact? e.g., "Compound risk refers to environments that are characterised by multiple failures that can amplify overall risk and/or cause cascading impacts"? and Page 44, Line 6-7, "Risks in the context of compound events and cascading impacts are an example of deep uncertainty because lack of data often prevents the assessment of probabilities and consequences of these risks." Does it mean the "cascading impacts" is the background of risk? Additionally, in Line 28, "cascading impacts" is mentioned before "risks" are mentioned. I am a little confused for these incosistent experssions. As a reader, I hope the impacts and risks can be mentioned in order and keep consistent in the chapter. [Rongshuo Cai, China]	cascading impacts refers to the impacts on natural and human systems as shown in Figure 6.1. The reference on Line 28 (section 6.8.2) has been revised to remove inconsistent usage of terms

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
16433	6	43	51	46	33	Please provide more details on the limits to adaptation and resulting implications, in particular under Section 6.8.4 [Alexander Nauels, Germany]	who is responsible for 6.8.4?
22345	6	43	53	44	16	This section would benefit by making an assessment of the confidence that compound events and cascading impacts are becoming more common/more damaging. This sentence hints at a global change signal ("Trends in geophysical and meteorological disasters and their interaction with more complex social, economic and environmental vulnerabilities are stretching existing governance and institutional capacities") but it would be very helpful to give an assessment of the literature and whether this is an area of growing risk. This assessment could draw upon the information in Box 6.1. [Abram Nerilie, Australia]	Assessment statement not really appropriate in this introductory section 6.8.1, but the next section on compound events (formerly in section 6.3) now contains an assessment statement.
23425	6	43	55	44	29	How could we understand the relationship between the risk and cascading impacts? This is because Page 43, Line 55 says that the compound risk refers to environment that can amplify overall risk or cause cascading impacts; however, Page 44, Line 6 refers to "Risks in the context of compound events and cascading impacts"? And Page 44, Line 27-29, mentions that "drivers trigger cascading impacts and risk". Does Risk causes impacts or Impacts cover risk? Frankly speaking, I am a little confused. Please note there are two "due to" in the sentence of Page 44, Lin2 27-29. [Rongshuo Cai, China]	Have changed the sentence 'Risks in the context of compound events and cascading impacts..' to 'Compound risks...'
11741	6	44	6	44	16	There is very recent empirical research undertaken in New Zealand on cascading impacts and their implications which will be published in January 2019 as part of the Deep South National Science Challenge Ref Lawrence, J., Blackett, P., Cradock-Henry, N. & Nistor, B.J. (2018). Climate Change: The Cascade Effect. Cascading impacts and implications for Aotearoa New Zealand. Wellington: Deep South Challenge. The wide implications of cascading impacts of climate change across domains and scales are reported. refer <a href="https://www.deepsouthchallenge.co.nz/projects/climate-change-cascade-effect">https://www.deepsouthchallenge.co.nz/projects/climate-change-cascade-effect</a> [Judy Lawrence, New Zealand]	This could be relevant to the social sections
8347	6	44	12	0		Change "not to" to "to not" [Nina Hunter, South Africa]	done
9243	6	44	13	44	14	there are not geophysical and meteorological disasters, they are triggered by geophysical and meteorological processes. All disasters are social, the outcome of societal decisions, as theorized by Quarantelli, E.L. (Ed.), 1998. What is a disaster: Perspectives on the question [Urbano Fra.Paleo, Spain]	changed 'disasters' to 'extreme events'
12955	6	44	18	44	34	Details are only limited to corals, although cascading impacts are a general problem in all ecosystems. Please make this more clear, or ideally provide evidence from other examples. [Government of Germany, Germany]	Accepted
1875	6	44	18	44	39	Again there is inconsistent terminology. What is the difference between "cumulative effects" in the header of sec. 6.8.2 and "cumulative risks" in the header of 6.8.3. And just below the latter header, the paragraph starts with "impacts on "compound risk events". What is that? [Jana Sillmann, Norway]	We have modified to reflect the latest development in compound events and cascading impacts. The terminologies you mentioned are removed as a result.
12957	6	44	18	44	39	As highlighted in our general comment to this chapter, terminology has to be used more consistently. 6.8.2 is titled "cascading impacts or cumulative effects on ecosystems" whereas 6.8.3. "cascading impacts AND cumulative risk" - why the differentiation between risk and effects? what is an effect other than an impact? Also, In 38 starts with "impacts on "compound risk events". What is that? Please be precise with concepts and wording. [Government of Germany, Germany]	We have modified to reflect the latest development in compound events and cascading impacts. The terminologies you mentioned are removed as a result.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11579	6	44	20	44	20	Also the important ecosystems of wetlands and salt marshes are important and have been damage, I would include them to the list of mangrove, coral reefs, polar deserts [Luca Castrucci, United States of America]	Accepted
8349	6	44	22	0		Change "showed" to "show" [Nina Hunter, South Africa]	Accepted
8351	6	44	23	0		Suggest change semi-colons to commas [Nina Hunter, South Africa]	Accepted
8353	6	44	26	0		Insert "to" after "due" [Nina Hunter, South Africa]	Accepted
8355	6	44	32	0		A word is needed before "2100"; Only "\$" or "USD" is required, not both [Nina Hunter, South Africa]	Accepted
11743	6	44	38	44	38	The word "accumulated" should be "cumulative". They are different meanings that are important to conveying the messag and be consistent with the section title. [Judy Lawrence, New Zealand]	Accepted
23427	6	44	38	44	38	How could we understand the "Impacts of compound risk events also have significant accumulated effects in the societal system." Dose it mean the risk has impacted on the societal system? It seams not so easy to understand the meaning or definition of risk and impact in some paragraphs. If we follow the the core concepts of the WGII AR5, the term risk is used primarily to refer to the risks of climate-change impacts. [Rongshuo Cai, China]	We have modified to reflect the latest development in compound events and cascading impacts. The terminology such as compound risk you mentioned is removed as a result.
11745	6	44	39	44	39	this sentence ignores a critical element which is the governance of those systems. The ability to deal with the disruptions in all the examples documented is largely influenced by absent or inadequately designed governance and institutional systems. Making this link here would reinforce this critical issue. Ref There is very recent empirical research undertaken in New Zealand on cascading impacts and their implications which will be published in January 2019 as part of the Deep South National Science Challenge Ref Lawrence, J., Blackett, P., Cradock-Henry, N. & Nistor, B.J. (2018). Climate Change: The Cascade Effect. Cascading impacts and implications for Aotearoa New Zealand. Wellington: Deep South Challenge. The wide implications of cascading impacts of climate change across domains and scales are reported. refer <a href="https://www.deepsouthchallenge.co.nz/projects/climate-change-cascade-effect">https://www.deepsouthchallenge.co.nz/projects/climate-change-cascade-effect</a> [Judy Lawrence, New Zealand]	governance discussed in 6.8.5, incorporated the reference
8357	6	44	40	44	41	Suggest change semi-colons to commas [Nina Hunter, South Africa]	Done
9245	6	44	43	44	44	there are multiple evidences of driving migration such as: O Dun, 2011. Migration and displacement triggered by floods in the Mekong Delta. International Migration, 49: 200-223. <a href="https://doi.org/10.1111/j.1468-2435.2010.00646.x">https://doi.org/10.1111/j.1468-2435.2010.00646.x</a> Myers, C.A., Slack, T. & Singelmann, Social vulnerability and migration in the wake of disaster: the case of Hurricanes Katrina and Rita. J. Popul Environ (2008) 29: 271. <a href="https://doi.org/10.1007/s11111-008-0072-y">https://doi.org/10.1007/s11111-008-0072-y</a> Sebak Kumar Saha. 2016. Cyclone Aila, livelihood stress, and migration: empirical evidence from coastal Bangladesh. Disasters, 41(3). <a href="https://doi.org/10.1111/disa.12214">https://doi.org/10.1111/disa.12214</a> [Urbano Fra.Paleo, Spain]	Migration is mentioned in the text as possible consequence of extreme and compound events, since it is a general introduction and overview we do not give single references to single events

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11747	6	44	44	44	44	The sentence "A combination of long-term scenario and responses of the economic sector ...." does not make sense. Should the word scenario be deleted? It is not clear what is being said here. [Judy Lawrence, New Zealand]	The sentence has been changed
8359	6	44	45	0		Change "indicated" to "indicates" [Nina Hunter, South Africa]	Accepted and changed according the new phrasing
14671	6	44	46	44	46	The final section on "knowledge gaps" is wholly inadequate and makes for very disappointing reading. This is one of the key sections of the report, which is very important for policy-makers and funders of research alike, who need this type of information to channel and shape new investments in research. A useful review of knowledge gaps should provide a clear and detailed analysis of the areas that need further research and investment, instead we found this section to be too vague and lacking the necessary level of detail. We therefore recommend that this is thought through again and re-written. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, the section on knowledge gaps was rewritten
22589	6	44	46	44	46	Suggest clarifying the statement to be "projected to result in an average 1.2% decrease..." [Government of Australia, Australia]	Accepted, the sentence has been rewritten
31509	6	44	51	44	52	please expand on this gender aspect, is this small scale establishments? in which regions / sectors? why are female owned establishment more vulnerable? [Hans-Otto Poertner and WGII TSU, Germany]	Explanation added - the case speaks of Hurrigan Katrina post-disaster research
1877	6	44	52	44	53	The sentence that starts with "Female-owned establishments..." needs further explanation in terms of why they are more challenged with business failures and if this statement is refereing to one specific event (i.e. hurricane Katrina), or is that a general finding. [Jana Sillmann, Norway]	Explanation added
22343	6	44	52	44	53	"Female-owned establishments are more challenged with failures than businesses owned by men". It would be good to expand on this to say why this is the case. [Abram Nerilie, Australia]	More explanation added
5117	6	44	53	44	54	It might be useful to provide an account of the difference. This might be useful in the planning of future responses. [Debra Roberts and Durban Team, South Africa]	The text has been changed
10103	6	45	11	45	17	Additional relevant examples of IKLK can be found in the following references from indigenous people around the world: Kihila, 2018 (Indigenous coping and adaptation strategies to climate change of local communities in Tanzania: a review, <a href="https://doi.org/10.1080/17565529.2017.1318739">https://doi.org/10.1080/17565529.2017.1318739</a> ); Audefroy and Cabrera-Sánchez, 2017 (Integrating local knowledge for climate change adaptation in Yucatán, Mexico, <a href="https://doi.org/10.1016/j.ijsbe.2017.03.007">https://doi.org/10.1016/j.ijsbe.2017.03.007</a> ); Nkomwa et al., 2014 (Assessing indigenous knowledge systems and climate change adaptation strategies in agriculture: A case study of Chagaka Village, Chikhwawa, Southern Malawi, <a href="https://doi.org/10.1016/j.pce.2013.10.002">https://doi.org/10.1016/j.pce.2013.10.002</a> ). [Elsa Arellano-Torres, Mexico]	Taken into account: references to IK and LK added with references in section 6.8.5
8361	6	45	12	0		In Chapter 1 it is referred to as "IK" and "LK" not "IKLK" - need consistency across chapters [Nina Hunter, South Africa]	Accepted, terminology has been corrected to ensure consistency with other chapters

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
23429	6	45	19	46	13	As a reader, I strongly hope to know how to reduce risk. Based on the concepts of the WGII AR5, risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems, or the authors also similarly mention that multiple hazards are interacting with vulnerability and exposure to trigger compound risk. Hence, how to reduce the exposure and vulnerability of natural and human systems is very expected to know in this section. [Rongshuo Cai, China]	Accepted, see section 6.1
25713	6	45	21	46	13	The section on 'Risk Management and Adaptation, Sustainable and Resilient Pathways', could also identify risk mitigation actions which could be undertaken at the regional/ global level. [Government of India, India]	Rejected, no literature was found on this point
32447	6	45	24	45	26	Past events have demonstrate, in some case, that businesses have the ability to organise and take responsibility when events occur. Cf Walmart study case during Katrina hurricane in New Orleans. (Zimmerman & Bauerlein, 2005)(Horwitz, 2009) in :The IRGC Resource Guide on Resilience, IRGC Foundation, vol.1. 2016 vol. 2. 2018; as well as in: IRGC guidelines for the governance of systemic risks <a href="https://irgc.epfl.ch/risk-governance/projects-resilience/">https://irgc.epfl.ch/risk-governance/projects-resilience/</a> [nicolas siorak, France]	Taken into account, a mention of the role of private sector in natech disaster management has been added
9247	6	45	27	45	27	It should read integrated disaster risk management. And harmonization with Climate Change policies -among others- as it is not effective to have two unrelated policies, disaster risk reduction and climate change mitigation [Urbano Fra.Paleo, Spain]	noted
17407	6	45	27	45	30	It would be worth highlighting some practical ways of achieving the integration of local knowledge alluded, building from successful programmes at country level. The paper should also emphasize the increasing need by local governments and the donor communities to design programmes that upgrade to commercial scales such local traditional knowledge and traditional practices, particularly, from the global South to support the implementation of disaster risks management and adaptation strategies. [Louis Lubango, Ethiopia]	these well-deserved points are discussed throughout different risk management and adaptation sections
8363	6	45	28	0		Change "partnership" to plural [Nina Hunter, South Africa]	the wording is modified
9249	6	45	28	45	28	and natech (risk or disaster events where technological and natural hazards are related), see the case of 2011 Tohoku disaster in Japan [Urbano Fra.Paleo, Spain]	done
9251	6	45	29	45	29	the responsibility should not be only over the local government, as multilevel governance proposes -including throughout the present report- but over all levels. And responsibilities should be differentiated, since local government does not have financial resources, human and material resources and it is dependent on transfers from higher levels. Thus, each level should have its own responsibilities, based on capacities and jurisdiction. Notwithstanding, lower levels of government should be hold accountable for their actions to higher levels of government [Urbano Fra.Paleo, Spain]	noted
9253	6	45	32	45	34	involvement of communities shouldn't be only to get IKLK but to also integrated them in decision making through public participation processes, and to further gain support for designed policy measures as well as greater disaster risk and CCA and CCM awareness, i.e. social learning. Also, the two basic forms of knowledge should be properly integrated: Marchi, B. 2015. Risk Governance and the Integration of Different Types of Knowledge. U. Fra.Paleo (ed.), Risk Governance. The articulation of Hazard, Governance and Ecology. pp. 149-65. DOI 10.1007/978-94-017-9328-5_9 [Urbano Fra.Paleo, Spain]	discussed in 6.9 governance section

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9255	6	45	36	45	36	and avoidance of hazard-prone areas, particularly through land.use planning [Urbano Fra.Paleo, Spain]	good point. In the word prevention, it includes avoidance of hazard-prone areas
14673	6	45	41	45	42	There is medium evidence that investing in disaster risk reduction has economic benefits' is an odd sentence. Surely it's self-evident that an appropriate level and the right sort of investment in disaster risk reduction has economic benefits. E.g. not building houses out of wood after the great fire of London... Can we just change this to 'Investing in disaster risk reduction can have economic benefits, but the range of the estimated benefits varies...'? [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the sentence has been rewritten to highlight that the medium evidence id about the reange of expected benefits, not on the fact that it is beneficial to invest in DRR
21229	6	45	41	45	46	The authors stated that there is 'Medium Evidence' that investing in DRR has economic benefits. However, several reports and case studies have confirmed that investing in DRR has economic benefits. For example, please read "Economic Aspects of DRR" (page 11 in particular) by UNISDR 2015; "Cost-effectiveness of disaster risk reduction and adaptation to climate change" by K4D 2018. There are of course challenges to 'Cost-Benefit Analysis', and the amount of benefit varies as also stated by the authors. It is usually higher in regions where basic infrastrurcutre is of poor quality and lower in regions where the basic infrastructure is of high quality. It can also vary if we consider the benefit gained by avoiding disaster damage only, or by considering economic benefits regardless of disaster as well. In my point of view, IPCC should adopt that there is 'High Evidence' in benefits gained through investment in DRR. [APECS Group Review, Germany]	Accepted, the sentence has been rewritten to highlight that the medium evidence id about the reange of expected benefits, not on the fact that it is beneficial to invest in DRR
8365	6	45	44	0		Change "system" to "systems" [Nina Hunter, South Africa]	Accepted-Text revised
8367	6	45	49	0		Suggest inserting "respectively" after percentages cited [Nina Hunter, South Africa]	Accepted-Text revised
9257	6	45	52	45	52	the statement "Engineered structures are also expected to reduce risks" is self-evident [Urbano Fra.Paleo, Spain]	Rejected, the comment is correct but this statement complements this part of the paragraph on ecosystem-based risk reduction.
8369	6	45	55	0		Change "flood" to plural [Nina Hunter, South Africa]	Accepted-Text revised
23307	6	46	0	46		Section 6.8.5 should include assessment of confidence in tools used and assessment of confidence in results. [Valerie Masson-Delmotte, France]	This was not possible
32643	6	46	0	49		I really enjoyed these case studies, and think they really illustrate the complexity of physical impacts and their translation to risk and vulnerability, and highlight the gaps in our societal structures/preparedness. Great job! [Kim Cobb, United States of America]	thanks
8371	6	46	1	0		Change "faces" to singular [Nina Hunter, South Africa]	Rejected: faces has 'cost-benefit analysis' as a subject

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11749	6	46	5	46	13	The challenges of costing and identifying benefits of risk reduction can also be addressed through the deployment of tools and methods that are more appropriate to changing risk profiles and uncertainty. The Society for Decisionmaking Under Deep Uncertainty website has many relevant publications to add something otherwise the chapter will not be up todate with practicces to address the problems raised in Mechler 2016. Here is one example about to be published. Lawrence J., R. Bell, and A. Stroombergen, A hybrid process to address uncertainty and changing climate risk in coastal areas using Dynamic Adaptive Pathways Planning, Multi-Criteria Decision Analysis & Real Options Analysis. Sustainability, 2019. Special Issue Policy Pathways for Sustainability(accepted in press). [Judy Lawrence, New Zealand]	Rejected, these issues of deep uncertainty are dealt with in Section 6.9
8373	6	46	9	46	10	It is not clear what is meant by "to the combined effects" [Nina Hunter, South Africa]	Accepted-Text revised
9259	6	46	9	46	10	the statement has an unclear meaning [Urbano Fra.Paleo, Spain]	Accepted-Text revised
8375	6	46	25	0		Suggest insert semi-colon after "Forest" [Nina Hunter, South Africa]	Accepted-Text revised
8377	6	46	30	0		Change "indicates" to singular [Nina Hunter, South Africa]	Accepted-Text revised
8379	6	46	32	0		Suggest replacing "concluding" with "and conclude" [Nina Hunter, South Africa]	Accepted-Text revised
21233	6	46	36	0		I suggest to minimize BOX 6.1 as it is possible, because a box extending 3 pages is big. [APECS Group Review, Germany]	Taken into account, the text of the box has been reduced
1879	6	46	38	46	43	Again, the use of terminology is confusing in Box 6.1. the header says "compound events and cascading risks" and in the paragraph just below (in line 43) it is referred to "compound risk and cascading impacts". Terminology should be aligned with Fig. 6.1 and glossary. The term "cascading risk" is not in the glossary. [Jana Sillmann, Norway]	The heading has now been changed to 'Multiple Hazards, Compound Risk and Cascading Impacts'
12959	6	46	38	46	43	As highlighted in our general comment to this chapter, terminology has to be used more consistently. Box 6.1. header states "compound events and cascading risks" and the paragraph just below (in line 43) refers to "compound risk and cascading impacts". Terminology should be revised and aligned with Fig. 6.1 and glossary. The term "cascading risk" is missing from the glossary. [Government of Germany, Germany]	We have altered text throughout to be consistent
8381	6	46	41	0		Suggest replace "to exacerbate" with "by exacerbating"; replace "cause" with "causing" [Nina Hunter, South Africa]	This has been done.
31511	6	46	45	0		given this report is focused on ocean and cryopshere, could this example increase focus on coastal and ocean impacts and costs? [Hans-Otto Poertner and WGII TSU, Germany]	We felt it was to late in the process to develop an entriely new case study
21235	6	46	56	46	56	Add into a parenthesis the months that consist the dry period in the studied region (The dry period (...) was ) [APECS Group Review, Germany]	the sentence has been shortened overall and these words removed
8383	6	47	3	0		Suggest remove commas before years for consistency [Nina Hunter, South Africa]	Done
21237	6	47	20	47	20	Add reference. [APECS Group Review, Germany]	Done
8385	6	47	34	0		Change "has" to "have" [Nina Hunter, South Africa]	Done
22593	6	47	36	47	36	Suggest using the term "depth" instead of "bathymetric". [Government of Australia, Australia]	this change has been made



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22591	6	47	50	49	45	Suggest clarifying the second and third case studies in box 6.1 to more explicitly state how the events described are multihazards or compound hazards (e.g. increased SST with lower sea-level leading to greater bleaching). A possible suggestion is to remove the second paragraph of case study 2 as it is just emphasising the uniqueness of the region which is already done in the first paragraph. [Government of Australia, Australia]	Taken into account, a sentence has been added to highlight the multiple and compounding risks. The second paragraph was not removed since it focused on the ecosystem services provided in the Coral Triangle, an important point; however, it was shortened and merged with the previous one
8387	6	48	5	0		Suggest change "and makes" to "which make" [Nina Hunter, South Africa]	Accepted-Text revised
8389	6	48	16	0		Insert "the" before "Coral" [Nina Hunter, South Africa]	Accepted-Text revised
21239	6	48	31	48	33	Please provide the reference of this index (DHW) [APECS Group Review, Germany]	Accepted: Reference added
8391	6	48	48	0		Suggest remove "a" [Nina Hunter, South Africa]	Accepted-Text revised
1779	6	48	57	0		Case study 3 three doesn't really illustrate examples of cascading risk or compound events - it is rather just a narrative about the hurricane season. Maybe the lessons with respect to risk could be drawn out better? [Mark Payne, Denmark]	done
15873	6	48	57	0		Case study 3 three doesn't really illustrate examples of cascading risk or compound events - it is rather just a narrative about the hurricane season. Maybe, the lessons with respect to risk could be drawn out better. [EUCE, Belgium]	done
16857	6	48	57	49	43	This analysis of hurricanes to affect the Caribbean is very helpful and should be retained. It may be helpful here to also mention that Barbuda was completely evacuated due to the storms and that this was the first time in 300 years that the island has been uninhabited. This was a significant challenge for the region and highlights non-economic effects. Please include this aspect! [Government of Grenada, Grenada]	done
28487	6	48	57	49	43	This analysis of hurricanes to affect the Caribbean is very helpful and should be retained. It may be helpful here to also mention that Barbuda was completely evacuated due to the storms and that this was the first time in 300 years that the island has been uninhabited. This was a significant challenge for the region and highlights non-economic effects. Please include this aspect! [Government of Saint Lucia, Saint Lucia]	Done
21241	6	49	14	49	14	Change "Harvey" to "Hurricane Harvey" [APECS Group Review, Germany]	Done
34081	6	49	14	49	17	The various estimates should be consolidated into a single value or range with a confidence level -- e.g., "It has been estimated that climate change increased the rainfall intensity of Harvey by at least 8% (van Oldenborgh et al., 2017, Wang et al., 2018, Risser and Wehner, 2017) (high confidence)." [Government of United States of America, United States of America]	This has been done.
34083	6	49	18	49	18	Do authors mean 'area-average' instead of 'area-integrated'. Area-integrated = a volume, not a height. [Government of United States of America, United States of America]	changed to area-averaged.
21243	6	49	19	49	20	General comment, add reference. [APECS Group Review, Germany]	have joined to the previous sentence to make clear that it is the same reference (Emanuel et al, 2017)
34085	6	49	19	49	20	Should a likeliness or confidence level be designated here? [Government of United States of America, United States of America]	high confidence has been added
21245	6	49	22	49	22	Add a sort description for Emanuel's method. [APECS Group Review, Germany]	In the interest of brevity a short description has not been provided but the text has been altered to make clearer that it is an event attribution method

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
34087	6	49	22	49	23	The paper that applied the Emanuel 2017 method to Irma should be explicitly referenced. [Government of United States of America, United States of America]	there is no additional reference to add here as Kerry Emanuel in his capacity as contributing author extracted the relevant information on wind speed from the runs in his 2017 paper
12961	6	49	33	0		Please use the term contaminants instead of pollutants. [Government of Germany, Germany]	Done
8393	6	49	37	0		Insert full stop before "Maria" [Nina Hunter, South Africa]	Done
8395	6	49	38	0		Suggest remove "is" and insert "the effects of Maria are" [Nina Hunter, South Africa]	Done
8397	6	49	41	0		Suggest change "country" to "countries" [Nina Hunter, South Africa]	Done
22347	6	49	48	52	42	There is lots of useful information in here, but it lacks the assessment (with confidence language) of the take home messages of current knowledge in this area. [Abram Nerilie, Australia]	Accepted - we now provide assessment and confidence statements in this section
22349	6	49	48	52	42	This section appears to be most relevant for extreme weather events. It is less clear how it applies to abrupt changes (e.g. collapse of AMOC) or extreme events in the interannual to decadal time scale (e.g. adaptation to prolonged droughts caused by ocean variability). [Abram Nerilie, Australia]	Rejected - we discuss relevant literature in the context of extremes and abrupt changes, starting with current DRM and adaptation literature as starting point.
22595	6	49	48	53	36	Suggest clarifying this section to better highlight the key messages: the need to tackle the impacts at multiple levels and via foundational activities (continue to do those things you do well and that have benefits), engaging in restoration and adaption activities, driving tranformative policy and legislation, empowering the community and reef-dependent industries through stewardship and engagement and supported/informed by good research and monitoring.  Suggest using lessons learned from the management of the Great Barrier Reef, and using the Great Barrier Reef Blueprint for resilience as an example of this could be valuable: <a href="http://www.gbrmpa.gov.au/our-work/reef-strategies/managing-for-a-resilient-reef">http://www.gbrmpa.gov.au/our-work/reef-strategies/managing-for-a-resilient-reef</a> [Government of Australia, Australia]	Rejected - these points are discussed in Section 6.9.2
15263	6	50	0	0		It is much appreciated that the authors touch on the issue of loss & damage here. Please expand on the loss & damage narrative in order to allow for a summary statement in the ES. [Government of Gambia, Gambia]	Accepted - we have expanded the text - SPM request to be resolved
23309	6	50	0	50		Loss and damage to be addressed with care, refering to SR15 box for framing . This paragraph is very generic, what about the literature specific to ocean and cryosphere changes? To be strengthened. Ethical aspects missing as well (incl. Implications of attribution work). [Valerie Masson-Delmotte, France]	Accepted - we now refer to relevant losses and damages reported in Chapter 6 and other chapters, although there is no space to comprehensively discuss all impacts.
8399	6	50	2	0		Suggest move "the" to before "spatial" [Nina Hunter, South Africa]	Taken into account. The text has been changed
14677	6	50	2	50	17	This paragraph ends by posing an important question without really answering it. Suggest statement starts with acknowledging that there are few studies on human adaptive responses specific to abrupt change and extreme events, but some other studies are relevant. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	This section is relevant for adaptation responses especially to abrupt and extreme changes. Other sections of the document address this topic such as Sections 1.5.2, 4.4 and 6.7.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9261	6	50	2	50	4	the statement is inconsistent since by starting with adaptation it is expected to identify the avenues for adaptation, such as institutional and livelihood, but risk reduction refers to one sector, -among the many involved- and resilience refers to a principle or target. These last two should be removed and instead refer to transition to a more resilient society supported by increased sustainability and social justice. Thomas, D. S. G., and C. Twyman. 2005. Equity and justice in climate change adaptation amongst natural-resource-dependent societies. Global Environmental Change 15:115-124. [Urbano Fra.Paleo, Spain]	Thank you for the comment. Changed and adjusted in the text,
11751	6	50	14	50	15	this question also needs to be asked whether the responses for extremes differ from anticipatory actions for climate change adaptation. This then links better with the Tol ref and sentence that follows. [Judy Lawrence, New Zealand]	Agreed, we have updated the sentence to reflect the suggested question.
9263	6	50	19	50	22	Sustaining decision making on the principle value for money is contradictory with previous statements on public participation, local knowledge or with adaptive governance. By simply adopting an economic approach, decisions will just be constrained to a balance between costs and benefits, without consideration of social or environmental impacts of the measures, as well as social acceptance. Adaptive governance is a better approach to shifts in environmental regimes: Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive Governance of Social-Ecological Systems. Annual Review of Environment and Resources, 30, 441-473. <a href="http://dx.doi.org/10.1146/annurev.energy.30.050504.144511">http://dx.doi.org/10.1146/annurev.energy.30.050504.144511</a> [Urbano Fra.Paleo, Spain]	All suggestions attended
11753	6	50	20	50	26	This list does not include applications of Real Options Analysis in real-life decision contexts which can be found in the following reference Lawrence J., R. Bell, and A. Stroombergen, A hybrid process to address uncertainty and changing climate risk in coastal areas using Dynamic Adaptive Pathways Planning, Multi-Criteria Decision Analysis & Real Options Analysis. Sustainability, 2019. Special Issue Policy Pathways for Sustainability(accepted in press). [Judy Lawrence, New Zealand]	Text adjusted accordingly
8401	6	50	24	0		Insert single quotation mark before "Robust Decision Making" [Nina Hunter, South Africa]	adjusted
11755	6	50	29	50	29	Add the following reference which takes the Haasnoot work further. Stephens, S., R. Bell, and J. Lawrence, Developing signals to trigger adaptation to sea-level rise. Environmental Research Letters, 2018. 13(10): p. 104004. [Judy Lawrence, New Zealand]	We consider it is adequately addressed
3043	6	50	33	50	44	This paragraph discusses the needs for "'actionable' information" in the area of adaptation to climate change. Climate services are expected to produce such actionable information. It could be useful for governments to see how the SROCC authors evaluate the climate services that exist already or that are being planned. Suggested example of references (among many others): Brasseur and Gallardo, 2016; Brasseur, G.P.; Gallardo, L. Climate services: Lessons learned and future prospects. Earths Future 2016, 4, 79–89. Plus Copernicus or other national or multinational climate services... [Goneri Le Cozannet, France]	Considered and adjusted
3041	6	50	35	50	35	Please note that (at least) one earlier paper highlighted the need for credible, salient, and legitimate' information. Cash, D.W.; Clark, W.C.; Alcock, F.; Dickson, N.M.; Eckley, N.; Guston, D.H.; Jager, J.; Mitchell, R.B. Knowledge systems for sustainable development. Proc. Natl. Acad. Sci. USA 2003, 100, 8086–8091. [Goneri Le Cozannet, France]	We consider it is adequately addressed

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
11757	6	50	35	50	35	The original reference to "credible, salient and legitimate is Cash 2003. The ones cited came later. Add Cash in to the list. [Judy Lawrence, New Zealand]	We have considered your kind suggestion.
8403	6	50	35	50	37	Sentence "Since ... abrupt change" - meaning not clear. Please clarify. [Nina Hunter, South Africa]	Done, text changed
9265	6	50	38	50	39	Despite trust in scienc is a prerequisite, it assumes that there is a direct link between knowledge and perception, perception and behavior, as well as between intention and behavior and this is not the complete picture. Intentions, attitudes, norms, expected outcomes and other factors take a role in behaviour. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179-21 1. [Urbano Fra.Paleo, Spain]	Done, text changed
17409	6	50	38	50	44	Among the potential barriers to flow of knowledge, technology and innovation between societies, cultures and organizations, scholarship on technology policy and studies rank large gaps in research and knowledge or technology endowments between them. Such gaps tend to give rise to mistrust, suspicions and apprehension mainly among the actors or groups that have less endowment. They latter tend to perceive partners with larger endowment as dominating the knowledge flow plans, dictating their own view, pushing their agenda, etc. It would be worth highlighting such large gaps between the North and global South (mainly LDC) on research and technologies can increase mistrust in the global South. Measures or programmes that address such research and knowledge gaps and subsequent mistrusts and other negative perceptions in national adaptation plans should then be emphasized. Notable among such measures have been outlined by Malgorzata Blicharska, et al., Nature Climate Change 7, 2017. Partnership aimed at harnessing traditional knowledge and traditional practices in the South should be emphasized as additional measures that can contribute to closing the knowledge gap alluded to early. [Louis Lubango, Ethiopia]	Done, text changed
22597	6	50	41	50	41	Suggest clarifying the term "institution" in this context. [Government of Australia, Australia]	Done, text changed
9267	6	50	41	50	42	this is contradictory since -at the same time- trust in institutions is fundamental for them to exist and have functions [Urbano Fra.Paleo, Spain]	sentence is rephrased and expanded
11759	6	50	42	50	42	The word 'disasters' is used here which makes an assumption that all extremes etc manifest as disasters. This is unfortunate because it leads to an assumption that only reactive responses are used rather than anticipatory actions to avoid damage and loss. The chapter needs careful attention to such wording to bring space for anticipatory actions under uncertainty and change using tools designed for this purpose. In addition disastser have a definitional problem because in some jurisdictions the label 'disaster' denotes funding availability. In these countries funding may be limited which means expectations of propection result that cannot be realised leading to civil unrest and other cascading impacts. [Judy Lawrence, New Zealand]	Agreed, we have reworded the term disaster here
16435	6	50	46	51	8	The authors are commended for establishing the link to the concept of loss & damage. As this topic becomes more and more important, the authors are encouraged to elevate a L&D summary statement to the ES. [Alexander Nauels, Germany]	Thanks, we indeed include Loss and Damage in the ES.

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
28489	6	50	46	51	8	The importance of the Loss & Damage concept requires related key findings to be elevated to the ES. Please provide a Loss & Damage statement in the ES and further strengthen the assessment if possible. [Government of Saint Lucia, Saint Lucia]	We updated the text, and also included a statement on Loss and Damage in the ES.
14675	6	50	47	50	47	"aims to address impacts beyond adaptation, as well as impacts of irreversible changes". Currently reads that L&D aims to address something beyond adaptation, irreversible changes and impacts. Please clarify what extra L&D brings over the robust frameworks outlined earlier in the chapter. [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	We clarified that L&D is the policy mechanism at the international level, to address residual and unavoids impacts. It is not another assessment framework.
5119	6	50	51	50	51	Consider elevating some the issues explored here to the executive summary [Debra Roberts and Durban Team, South Africa]	We will indeed mention Loss and Damage in the ES.
8405	6	50	56	0		Change "identifying" to "identify" [Nina Hunter, South Africa]	Agreed, text changed
9269	6	51	2	51	2	Insurance is an adaptation mechanism at the individual level but not at the societal level, since it is based on risk transfer among a large number of members of society. On the contrary, insurance may drive maladaptation since a policyholder may incur in risk being confident that if something happens damages may be covered by the insurance policy. P. O'Hare, I. White, A. Connelly, Insurance as maladaptation: Resilience and the business as usual paradox. Environ. Plan. C: Polit. Space 34(6), 1175-1193. [Urbano Fra.Paleo, Spain]	Sovereign insurance mechanisms help governments to absorb large losses, benefitting society, we will add this. The morale hazard that the reviewer points to, and which is well-known, can be addressed by insurance design, this is addressed in several of the referenced publications.
11761	6	51	8	51	8	Use of the words "under control" is problematic. What is more appropriate is "within coping and adaptive capacity". Any suggestion that adaptation and risk reduction can be 'controlled' is misleading and raises expectation of 'safety' and demands on governments to pay for more protection when other options are more sustainable. [Judy Lawrence, New Zealand]	Agreed. We adjusted the wording, and stress that risks should remain insurable.
9271	6	51	13	51	13	Adaptive governance (see line 27) [Urbano Fra.Paleo, Spain]	The sentence reads governance for an effective adaptation and describes adaptive governance - we would like to stick to this wording
11763	6	51	14	51	14	add after the reference to Patterson the following " that 'fit' the problem type ."Young, O., The Institutional Dimensions of Environmental Change: Fit, interplay, and scale. 2002, Cambridge Massachusetts and London MIT Press. 221. This sentence is about "effective" adaptation and the changes in practices, processes and structures have to fit the type of problem to be effective. The problem is rife with uncertainties and some governance works better than others. Participatory and anticipatory governance systems better fit the nature of the climate change problem. This is fundamental to addressing sea level rise in particular. [Judy Lawrence, New Zealand]	Agreed, and added reference Young 2002.
9273	6	51	20	51	22	The most adequate instrument to design policies and plan is Integrated Coastal Zone Management (ICZM). Elisabetta Genovese & Valentin Przulski (2013) Storm surge disaster risk management: the Xynthia case study in France, Journal of Risk Research, 16:7, 825-841, DOI: 10.1080/13669877.2012.737826 [Urbano Fra.Paleo, Spain]	Rejected, the problem described here is precisely that traditional ICZM is not capable to do this, as is focused on conservation of functions, rather than transformational change

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32449	6	51	20	51	52	Methodologies inspired by businesses practices and study cases could be useful to tackle the lack of coordination. protocols and preparation, as well as contingency planning. Cf IRGC references. [nicolas siorak, France]	We reviewed and included the materials accordingly.
8407	6	51	23	0		Change "induce" to "induced"; change "framework" to plural [Nina Hunter, South Africa]	Corrected
8409	6	51	30	0		Insert "a" before "crucial" [Nina Hunter, South Africa]	Corrected
9275	6	51	38	51	41	risk communication is a continuing process, and should not be understood as a top-down policy but as a process that occurs continuously among all societal actors. Thus awareness and political will of decision makers can be shifted as well by strengthening communication of risk with them. Feldman, D. L., & Ingram, H. M. (2009). Making science useful to decision makers: Climate forecasts, water management, and knowledge networks. Weather, Climate and Society, 1(1): 9–21. [Urbano Fra.Paleo, Spain]	Here we address risk communication in the context of disaster warning and not a societal process of communicating risk to public.
12963	6	51	43	51	46	Please add a sentence along the following lines after lines 43-46: Approaches to enhance the links between adaptation and disaster risk reduction as well as good practice cases to fulfil both the targets of UNFCCC as well as of the Sendai Framework are provided in EEA, 2017: Climate change adaptation and disaster risk reduction in Europe. Enhancing coherence of the knowledge base, policies and practices; EEA, 15/2017. [Government of Germany, Germany]	Taken into account - The sentence has been rewritten and the reference has been added
11765	6	51	46	51	46	Add "and climate change adaptation" after "risk reduction" The whole point of this statement is that the two need to be integrated. Add the following reference which addresses this point Lawrence. J. and W. Saunders, The planning nexus between disaster risk reduction and climate change adaptation, in The Routledge handbook of disaster risk reduction including climate change adaptation J.M. I Kelman, JC Gaillard, Editor. 2017, Routledge: London & New York. p. 418-428. [Judy Lawrence, New Zealand]	Accepted - Text revised
25703	6	51	46	51	50	Mainstreaming climate concerns requires financial, technological and capacity-building support as critical enabler. This aspect could be appropriately included. [Government of India, India]	The lack of specific capacity building is mentioned as one major problem for integration in the following paragraph (page 51, line 57)
12881	6	51	49	41	52	It would be more accurate to say that: The physical mechanisms leading to this northward shift are not resolved in coarse resolution models. Or if you want to leave the sentence as it is you should cite Saba et al. (2016) instead of Caesar et al. (2018), as the missing warming in the Gulfstream region in coarse resolution models was shown by Saba et al. (2016). [Levke Caesar, Germany]	Accepted - this has been corrected.
16551	6	51	51	51	52	The statement should be revised or clarified a rank of the classification. Because we have a Conference of the Parties to the United Nations Framework Convention on Climate Change (COP). Recently, we have organized the COP 24 in Poland which gathers about 200 countries in the world to express concern about climate change impacts and commit to reduced gas emission and maintain the changes in global temperature is about 1.5 C at the end of the century. It shows that the effort of almost countries fights together to the climate change. [Hoang Anh Le, Vietnam]	Please acknowledge that this section focuses on intra-government cooperation, not inter-government cooperation
21247	6	51	52	52	1	Rephrase the sentence. I propose to separate it in tow smaller sentences. [APECS Group Review, Germany]	Taken into account - the text was modified

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
15875	6	51	54	51	55	Nature volume 472, page 135 (14 April 2011) argues that data released in more user-friendly ways can speed up decision-making in disasters. (They used the Fukushima example) [EUCE, Belgium]	Taken into account, a more recent reference was added
23311	6	52	0	52		Section missing conclusion (key finding, "in summary, ... with confidence language). [Valerie Masson-Delmotte, France]	Text has been amended in the meantime
8411	6	52	4	0		Suggest remove "on" [Nina Hunter, South Africa]	Accepted - Text revised
8413	6	52	8	52	9	"reducing ... overlook" - phrase not clear, please rephrase [Nina Hunter, South Africa]	Accepted -Sentence modified
11767	6	52	11	52	11	Add "Real-life decision examples are emerging and have been mainstreamed in national guidance, for example, in New Zealand using adaptive pathways approaches for coastal hazard strategies Bell, R., et al., Coastal hazards and climate change: Guidance for local government. Ministry for the Environment Publication ME-1341. 2017, Ministry for the Environment: Wellington. Important to acknowledge that developed countries are making some progress in this area. Lessons are being learned from their implementation. [Judy Lawrence, New Zealand]	Accepted - Sentence modified and reference added
11769	6	52	15	52	42	This text would be improved by substantial pruning in length. The focus is too disaster oriented and also needs to be made relevant to CCA e.g. marine heat waves would not be called 'disasters' as used in the DRR community. The discussion needs to be inclusive of the different types of climate change impacts. [Judy Lawrence, New Zealand]	Taken into account - The text has been shortened. However, the focus remained on disaster since this sector provides lessons learned that can be used in extreme events related to climate change, even if they are not considered disasters in the DRR community
8415	6	52	16	0		Suggest remove "e.g." so that the sentence makes sense [Nina Hunter, South Africa]	Accepted - Text revised
8417	6	52	21	0		Change "activate" to plural [Nina Hunter, South Africa]	Accepted - Text revised
32451	6	52	34	52	34	Regarding international, regional, subnational and transboundaries cooperation, private actors have such operating spaces and geographical decision levels. Symetric and asymmetric choocs on these operational levels induce multi-level reactions of companies involved, both in ex ante and ex post events. grey literature from the agri-food industry [nicolas siorak, France]	Rejected - although the role of private actors is important, so are other stakeholders. Listing examples of all their decisions levels and processes would go beyond the scope of this chapter
8419	6	52	35	52	36	Suggest rephrase: "that reduced ... India" to "in which Indian fatalities from Cyclone Orissa of over 10,000 in 1999 were reduced to 45 from Cyclone Phallin" [Nina Hunter, South Africa]	Accepted - Text revised
8421	6	52	36	0		Please insert the year that Cyclone Phallin took place in [Nina Hunter, South Africa]	Accepted - Text revised, yeas included
22599	6	52	36	52	36	Suggest that Cyclone Phallin needs a year (temporal context) to demonstrate the point of this sentence. [Government of Australia, Australia]	Accepted - Text revised, years included
8423	6	52	37	0		Insert "the" before "Disaster" [Nina Hunter, South Africa]	Accepted - Text revised

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
9277	6	52	40	52	42	the command and control demonstrates its efficiency in disaster response -according to an emergency plan- and this clarification is needed since command and control may also refer to a mode of disaster risk governance, that is questioned by, for example, R. Burby and P. May: Burby, Raymond J. and Peter J. May.2009."Command of Cooperate: Rethinking Traditional Central Governments' Hazard Mitigation Policies."Pp. 21-33 in Building Safer Communities.Risk Governance, Spatial Planning, and responses to Natural Hazards, edited by Urbano Fra Paleo. Washington DC: IOS Press [Urbano Fra.Paleo, Spain]	as this paragraph on coordination overly skewed towards disaster management so removed
16799	6	52	47	53	36	FAQ6.1: This FAQ addresses too many issues at the same time. The overall question is too general and broad. Individual questions raised here are important, and valid "FAQ-material", however we doubt that anyone would really ask how risks of extremes and abrupt change in the ocean and cryosphere can be addressed, as this scope is specific to this report. We'd strongly encourage the authors to separate the issue of extreme events from that of dealing with abrupt change. Abrupt change, tipping points and the uncertainty surrounding them (and what that means for decision making) would surely merit a standalone FAQ. If you can have only one, we'd appreciate a focus on abrupt change, as ESL is already covered (partly) in FAQ4.1, and responses to other Ocean and Ice-related extremes (marine heatwaves, storms, Landslides,...) span such a broad range that we do not really see a red thread that could be meaningfully woven into an FAQ. On the existing text, please note that the statement on p 53 in 11-13 doesn't give a correct representation of the mechanism triggering WAIS collapse. [Government of Germany, Germany]	Taken into account, the text to re-focus on abrupt changes and their management
22355	6	52	47	53	36	The adaptation/management parts of FAQ 6.1 focus just on communities, and not on ecosystems. Maybe the title of the FAQ could be changed to focus the FAQ on impacts to communities, or adaptation/management options for ecosystems could be added to the text. [Abram Nerilie, Australia]	Taken into account, text was added to briefly present the management of risks to ecosystems
22601	6	52	47	53	38	Suggest condensing the text in the FAQ. Particularly the first three paragraphs that describe what extreme events and abrupt changes are but that don't describe how to address them. [Government of Australia, Australia]	Accepted - the text has been condensed with a focus on abrupt changes
11771	6	52	53	52	53	It is not clear what "more gradual warming is referring to. Please clarify. [Judy Lawrence, New Zealand]	Accepted - The term 'more gradual' was removed
21249	6	52	56	52	56	Give some examples for the impacts. [APECS Group Review, Germany]	Taken into account - The paragraph has been removed
23313	6	53	0	53		Two different sections (summary => RFC; gaps to be separated). Traceability to text and assessed literature and expert judgment missing for RFCs. Confidence assessment needs to be provided as in SR15. I would suggest to have different panels for extremes and for abrupt changes, not combine them. [Valerie Masson-Delmotte, France]	I think this comment is for the summary, not for the FAQ
8425	6	53	2	0		Insert "to" after "lakes" [Nina Hunter, South Africa]	Taken into account - The paragraph has been removed
21251	6	53	4	53	4	Mention some years with extreme high temperature episodes [APECS Group Review, Germany]	Taken into account - The paragraph has been removed



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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
22351	6	53	11	53	12	"The collapse of the West Antarctic ice sheet is considered be the highest risk of abrupt change": I don't recall this being mentioned in the main text of the chapter. This seems important for a chapter focused on abrupt change and so this information should be added clearly within the main chapter text, with reference to the section of SROCC that assesses collapse of the West Antarctic ice sheet. It would also be good to include the assessment language that SROCC gives for WAIS collapse in the chapter 6 summary. [Abram Nerilie, Australia]	Accepted - The text was revised to match the main text of the chapter
22353	6	53	17	53	17	"Reducing greenhouse gas emissions helps to limit the occurrence of extreme events and abrupt changes". A stronger statement should be made here about reducing risk and choices of different emission scenarios [Abram Nerilie, Australia]	Accepted - the text was revised
8427	6	53	19	0		Suggest replace colon with full stop [Nina Hunter, South Africa]	Accepted- Text revised
11773	6	53	19	53	21	This point is very important but I didn't see it in the text (I may have missed it?). It relates to my comment on different types of impacts and the nature of the climate change problem. All impacts are not disasters nor do they propagate in the same way. Decision makers need to know this. [Judy Lawrence, New Zealand]	Taken into account, the text has been modified to include this point and in the text as well. However, the FAQ box is not a summary of the chapter text
8429	6	53	21	0		Change "with" to "to" [Nina Hunter, South Africa]	Accepted-Text revised
8431	6	53	23	0		Suggest remove "a" [Nina Hunter, South Africa]	Accepted-Text revised
32453	6	53	25	53	25	As well as the availability of health and energy systems. [nicolas siorak, France]	Taken into account, the example of energy supply was added. The reference to health, although relevant, requires more explanation that available in this FAQ
8433	6	53	28	0		Suggest remove "A" [Nina Hunter, South Africa]	Accepted-Text revised
9279	6	53	28	53	36	while the reference to transformative governance in the second part of the paragraph is conclusive, the first part is contradictory and incomplete. The solution is not just management but governance, the resources mentioned are neither all not the most important, however spatial planning is a key policy instrument in risk avoidance, a first step in DRR, Fra.Paleo, U. 2009. Building safer communities. Risk governance, spatial planning and responses to natural hazards. Amsterdam: IOS Press. and the social ecological-ecological approach should be adopted as a comprehensive framework: H.E. Allison. 2015. Understanding and Conceptualizing Risk in Large-Scale Social-Ecological Systems. U. Fra.Paleo (ed.), Risk Governance. The articulation of Hazard, Governance and Ecology. pp. 99-115. DOI 10.1007/978-94-017-9328-5_6 [Urbano Fra.Paleo, Spain]	Taken into account, the text has been modified
12107	6	53	28	53	36	The response approaches given here are rather simple. So it is suggested to put forward more comprehensive strategies and countermeasures, fully explaining the limitations of adaptation, the current level of adaptability and so on. [Government of China, China]	Taken into account, the text has been modified to reflect this point. However, the FAQ is not the best place to go into details into the description of comprehensive strategies

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
32455	6	53	28	53	36	Economic and market signals could be stressed as a leverage to improve resilience to extreme events. Displacement of production and trade infrastructures use to impact the implementation of their workforce and their soft assets. As infrastructure are amortized on a long time (up to 50 YEARS), economic valuation of assets will influence the degree or preparation to extreme events, by modifications of land use planning and retreat form the area of assets when possible. [nicolas siorak, France]	Rejected: this is an interesting point but the FAQ is considered not to be the most relevant place to discuss it. However a mention of other stakeholders than government agencies has been added
2805	6	53	45	53	45	6.10.1 Summary. It only provides one figure and more texts should be added. [Chunzai Wang, China]	Figure now removed. ES provides summary
12109	6	53	45	53	45	6.10.1, a section that is a summary of the report, is no more than one figure. So it is suggested to add a detailed text. [Government of China, China]	Figure now removed. ES provides summary
29131	6	53	45	54	1	Per comment in Row 63, above; this Burning Embers diagram needs to include the other processes noted in Tabel 6-1 (might be consolidated, for example all permafrost-related dynamics encompassed by a single "ember.") [Pam Pearson, Sweden]	Figure now removed
16437	6	53	45	54	5	Please make sure that the burning embers graphic is consistent with the SR1.5 assessment regarding underlying assessment but also visual presentation. In addition, please provide a summary of key aspect shown in Figure 6.11 as part of Section 6.10.1. Only showing the figure is not sufficient. [Alexander Nauels, Germany]	Figure now removed
23315	6	54	0	54		"are required" is prescriptive, reformulate. [Valerie Masson-Delmotte, France]	Accepted and re-phrased
31513	6	54	1	0		please ensure the methods and information underpinning this figure are in the annex material [Hans-Otto Poertner and WGII TSU, Germany]	Figure now removed
12965	6	54	1	54	1	Fig. 6.11: Colors are missing / not displayed properly [Government of Germany, Germany]	Figure now removed
1011	6	54	1	54	5	Fig. 6.11: Could you define acronyms ENSO, AMOC, and SPG in the caption? [Ethan Kyzivat, United States of America]	Figure now removed

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
25577	6	54	2	0		<p>"The assessment of risks in Figure B) is questionable and illustrates the limits of the burning embers concept for less aggregated risks than the RFCs. Additionally, the selection is far from being comprehensive and the reason for the selection is not clear. For example: Why is the SPG selected and not Arctic sea ice? Why is there no assessment of the tipping risks for West and East Antarctica and Greenland? Why nothing on glaciers? Furthermore, the temperature scaling appears to differ from Fig. 6.11, which doesn't help either...</p> <p>My comments here are based on Fig. 6.11 as this temperature scaling actually seems to be more reasonable to me.</p> <p>Specifically:                      Cyclones: Present a high risk in regions where they occur already as a natural phenomenon. Not touching on the questions of occurrence, confounding factors increasing the impact such as reduced speed (Kossin 2018), precipitation (van Oldenborgh 2018) and sea level rise (Lin et al. 2016) exhibit a clear climate change signal. The assessment of risks as 'undetectable-moderate' therefore is questionable. And the translation to 'high' risks only beyond 4°C is difficult to comprehend and there is no literature that I am aware of that supports this.</p> <p>Extreme ENSO: Key literature including (Cai et al. 2014-2018) points towards a doubling of more extreme El Nino events already at 1.5°C (Wang et al. 2017) and intensifying further post 2100. How comes this is 'undetectable' risk?</p> <p>AMOC: Is slowing down already today. (Rahmstorf et al. 2015, Caesar et al. 2018 and others.) How is this not detectable?</p> <p>SPG: What's the global relevance of the SPG? Why is it selected here? And what is the literature this assessment is based on?</p> <p>Compound events: Unlike the others, these are aggregated across many risk categories. This makes it difficult to compare." [Schleussner Carl-Friedrich, Germany]</p>	Figure now removed
25579	6	54	2	0		<p>More specifically on the SPG: The underlying literature (Drijfhout et al. 2015) indicates that most threshold for circulation changes including the SPG are already tipped below 2°C warming. Other literature (i.e. Mengel et al. 2012, Schleussner et al. 2013,15) indicates that it might be already tipped today. What is the basis for putting high risk thresholds beyond 4°C? [Schleussner Carl-Friedrich, Germany]</p>	Figure now removed
8435	6	54	3	0		Change "assess" to "assessed" [Nina Hunter, South Africa]	Figure now removed
8437	6	54	3	0		Colours are mentioned but not evident in the figure? [Nina Hunter, South Africa]	Figure now removed
34089	6	54	3	54	3	"Purple" appears to be dark red. [Government of United States of America, United States of America]	Figure now removed

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Comment id	Chapter	From page	From line	To page	To line	Comment	Chapter Team Response
14679	6	54	8	54	41	"The main challenges include that EbA implementation demands socio-ecological research and understanding of the system (Wasson et al., 2015; Scarano, 2017). Solutions are typically site specific; tend to need time to be fully functional and typically need more space than grey measures." No mention of political challenges or of involvement of local communities in decision-making at this stage - although recognise that this is outlined in more detail in section 4.4.5.5.1 [Government of United Kingdom (of Great Britain and Northern Ireland), United Kingdom (of Great Britain and Northern Ireland)]	Noted
1013	6	54	14	54	23	This paragraph should mention uncertainties in emissions scenario. Although this might not be a "knowledge gap" per se, since it is unknowable, it is certainly a key unknown in projecting impacts. Figure 5.6 in Ch 5 shows that scenario uncertainty ranges from about 1-99% for predicting key ocean variables, especially pH. [Ethan Kyzivat, United States of America]	Considered too generic an issue.
21253	6	54	20	54	21	I suggest to add some references and to delete the word "may" . [APECS Group Review, Germany]	Rejected. We don't know if improvements in models will reduce uncertainty
1015	6	54	25	54	26	The "while" clause here detracts from the credibility of previous statements and assertions about quantifying changes in risks. Note the paragraph in Box 6.1, Case Study 3 on p. 49, lines 14-20, where changing probabilities of rare and extreme events such as high winds and rainfall are quantified. I think you could clarify in the "while" clause that you are talking about irreversible phenomena such as marine ice shelf collapse or AMOC disappearance, not "more common" extreme events such as hurricanes. [Ethan Kyzivat, United States of America]	Also talking about very rare events
8439	6	54	26	54	27	More useful to policy makers than who? [Nina Hunter, South Africa]	More useful than no information
22791	6	54	31	54	31	I totally agree with the conclusion about "a serious lack of literature is in the assessment of the economic impacts of extreme". There is however some recent initiatives especially in the domain of fluvial flooding, e.g. Paprotny et al. (2018), which may be worth acknowledging.  Reference Paprotny, D., Sebastian, A., Morales-Nápoles, O., & Jonkman, S. N. (2018). Trends in flood losses in Europe over the past 150 years. Nature communications, 9(1), 1985. [Jeremy Rohmer, Finland]	Noted
1017	6	54	40	54	41	This sentence is wordy; perhaps shorten to: "Researchers who can cross boundaries between these disciplines <will help> accelerate research in the areas covered by this chapter. [Ethan Kyzivat, United States of America]	Accepted
21255	6	54	41	54	41	I propose to mention that the co-operation between researchers from several fields is also required. [APECS Group Review, Germany]	That is implied
16569	6	59	34	59	34	Darmaraki et al 2018, will probably be Darmaraki et al 2019, [Sofia Darmaraki, France]	Accepted - reference updated
9863	6	69	57	69	61	Meinen, C. S., S. Speich, A. R. Piola, I. Anson, E., Campos, M. Kersalé, T. Terre, M. P. Chidichimo, T. Lamont, O. Sato, R. Perez, D. Valla, M. van den Berg, M. Le Hénaff, S. Dong, and S. Garzoli, (2018) Baroclinic and barotropic flows and the dueling influence of the boundaries. Geophys. Res. Lett., DOI: 10.1029/2018GL077408 [Government of France, France]	Now cited