#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
1	57532	19	0	0	0	0	All references in this chapter should be refer to a fix format.Do not missing out the necessary information. (Ying Li, National Climate Center)	The references section has been completed for the FGD.
2	57558	19	0	0	0	0	Base years should be identified throuout this chapter.Though there is a sentense that "In this section, all warming scenarios are relative to pre-industrial levels unless otherwise noted" in 19.5.1, this seems to apply only to this section. For example, in page 5, line 42, page 40, line 8 and line 31 in the same page, no base years are shown. There is a large difference between, for exam;e, 2 degree increase since pre-industrialization and since some other year such as 1990. This difference has a huge policy implication for international negotiations. To avoid any nisunderstandigs, base year should be made clear enough. (Mitsutsune Yamaguchi, The University of Tokyo)	The chapter has been edited carefully to make baseline references clear.
3	57559	19	0	0	0	0	There are several cases where impacts are evaluated based on SRES A2 scenario. However, this scenario is rather unrealistic especially in population projection. Among 6 marker scenarios, projection of world population is the highest. For example, in A2 scenario, world population is projected to be 11 billion in 2050 and 15 billion in 2100 (ref. p. 363 in SRES). On the other hand UN mean population projection in 2050 is 9 billion. Thus impact based on A2 scenario tends to be higher than the one based on other scenario. Another point is that global emissions and temperature increase in 2100 are the highest in A2 scenario (ref. Figure SPM.5 in page 7 of the synthesys report of AR4. In that sense, in citing impact figures based on A2 scenario, some kind of note should be accompanied in order not to mislead readers. The followings are examples. 1) Page 18, line 6 2) Page 21, line 1 3) Page 26, line 40 4) Page 36, line 52 (Mitsutsune Yamaguchi, The University of Tokyo)	We are limited to using the scenarios on which the literature for impacts is based.
4	57789	19	0	0	0	0	Throughout the chapter and particularly in the chapter summary, there are statements that "risk is increasing" due to one thing or another. I find little information content in such a statement. All change involves some risk, so risk increases with change of any kind. The future is uncertain and therefore risky. Not changing, also involves risk. I recommend changing the statements as much as possible to quantitative measures of impact on human and natural systems. I find many of the statements of increasing risk while true to be misleading. I recommend in the future, IPCCs to limt this type of language. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	While the comment has some merit and we have tried to be more specific where possible, the use of even this general term needs to be understood in terms of the definition of risk used in this chapter. The emphasis in this chapter is on harmful outcomes, in line with the meaning of Article 2. Therefore a statement of sign of change of risk is meaningful.
5	59743	19	0	0	0	0	General Comment 1: A proposed summary statement for the Synthesis Report (SR). The AR4 included an excellent section about large scale singular events, and the draft AR5 includes a similar one. The following summary statement is included in the TS on page 53, lines 34 and 35, and in the SPM on page 16, lines 33 and 34: The risk associated with large-scale singular events such as at least partial deglaciation of the Greenland ice sheet remains comparable to that assessed in AR4. [19.6.3] The AR4 concluded that partial deglaciation would occur over a period of time ranging from “centuries to millennia” for a global average temperature increase of 1-40C (relative to 1990-2000). The AR5 TS and SPM references to the AR4 conclusion, and the phrase “such as,” implies that information about stability of all ice sheets has not changed since the 2007 publication of AR4. I reviewed also the AR5 WGI report about physical driving forces. The WGI summarized in part that: There have been exceptional changes in Greenland since 2007 marked by record-setting high air temperatures, ice loss by melting, and marine-terminating glacier area loss (Mernild et al., 2012; Hanna et al., 2012; Section 4.4.4). (WGI FOD Chapter 10 about Detection and Attribution of Climate Change—from Global to Regional, Section 10.5.2.1, p. 10-4, lines 40-42; other WGI summary statements about observed melting of ice-on-land are copied in the appendix) (Thomas Dunning Newbury, U.S. Department of the Interior (retired))	While it is true that there are many new observations of the Greenland ice sheet since AR4, there have also been new model simulations and paleoclimate studies. Taken together, these do not materially alter the assessment of the risk of a large-scale singular event.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
6	59744	19	0	0	0	0	General Comment 2: There is an apparent discrepancy between WGI and II about changes in the Greenland Ice Sheet. Any change would be important because of sea-level implications. The consequences seem too great for an apparent discrepancy about large-scale singular events (i.e., about tipping points, or irreversible changes). One solution might be that the conclusions about the stability of the ice sheets could be synthesized further by the lead authors for the WGI Chapter 4 about Observations: Cryosphere, WGI Chapter 10 about Detection and Attribution of Climate Change—from Global to Regional, WGI Chapter 13 about Sea-level Change, WGII Chapter 19 about Emergent Risks and Key Vulnerabilities, and WGII Chapter 28 about Polar Regions. Based primarily on my review of the WGI report, I suggest the following slight modification of the AR5 conclusion about ice sheets. The WGII Section 19.6.3.6 refers to not only to the Greenland Ice Sheet, but also to the Antarctic Ice Sheet (page 45, line 43), and specifically to the western portion of the Antarctic Ice Sheet (i.e., the West Antarctic Ice Sheet or WAIS) on the West Antarctic Peninsula (i.e., the WAP) (page 45, line 39). The WGI report describes major changes in the Greenland Ice Sheet and the WAIS, but only minor ones in the huge East Antarctic Ice Sheet. So, I suggest that the AR5 conclusion about consistency with AR4 should refer to the East Antarctic Ice Sheet rather than to the WAIS or the Greenland Ice Sheet. Specifically, I suggest the following conclusion for Chapter 19, Section 19.6.3.6, page 46, lines 37-38: Based on the weight of the above evidence, we judge that the risk from large-scale singular events, such as large-scale irreversible deglaciation, of the East Antarctica Ice Sheet, remains comparable to that assessed in AR4, as indicated by Smith et al. (2009) and Figure 19-5). (Thomas Dunning Newbury, U.S. Department of the Interior (retired))	see response to comment #5.
7	59745	19	0	0	0	0	General Comment 3: The similar conclusion could be repeated in the Chapter 19 Executive Summary (Chapter 19, page 5, lines 25 and 26); i.e.; The risk associated with large-scale irreversible deglaciation, of the East Antarctica Ice Sheet remains comparable to that assessed in AR4 (19.6.3.6). In contrast, the WGII Technical Summary and Summary for Policymakers should summarize both Chapter 19 and Chapter 28 about the Polar Regions. The latter chapter contains summaries of ecosystem changes, such as “rapid colonization of ice-free ground” (Chapter 28, page 25, lines 35-38). So, the overall TS could conclude that (WGII, TS, page 53, lines 34 and 35): The risk associated with large-scale irreversible deglaciation, of East Antarctica Ice Sheet remains comparable to that assessed in AR4 (19.6.3). However, rapid changes have been reported in the terrestrial ecosystems of Greenland (28.2.3.7). A similar conclusion could be reported in the WGII SPM (WGII, SPM, page 16, lines 33 and 34) I have submitted the above suggestions also as WGII page-specific comments. However, the following suggestions are about the overall Synthesis Report rather than just the WGII report, and have not been submitted elsewhere. If the above conclusions are included in the overall Synthesis Report (SR), the conclusion should be combined with information from WGI. Some of the WGI information about abrupt changes in the ice sheets is copied above. An appropriate conclusion for the SR might be: The risk associated with large-scale singular events, such as deglaciation of the East Antarctica Ice Sheet remains comparable to that assessed in AR4. However, the Greenland and West Antarctic Ice Sheets have been melting at record-setting rates, and the rates appear to be accelerating, so partial deglaciation might occur sooner than predicted in AR4 [WGI Sec. 10.5.2.1, WGII Sec. 19.6.3] (Thomas Dunning Newbury, U.S. Department of the Interior (retired))	See response to comment #5.
8	61457	19	0	0	0	0	The revised chapter is much clearer on the definition of key terms than the previous draft. However, the two discussion strands addressing key vulnerabilities and key risks appear rather unrelated. For example, the seperation of criteria for key vulnerabilities (in Section 19.2.2.1) and for key risks (in Section 19.2.2.2) is not fully convincing. If risk is conceptualized as the combination of physical hazards and exposed vulnerable systems, the criteria for key vulnerabilities should be *a part* of the criteria for key risks. This is, however, not the case, and the criteria for key risks are actually much fewer than those for key vulnerabilities. The discussion of key vulnerabilities in Section 19.6.1 is interesting but does not seem to inform much the presentation of key risks in Section 19.6.2 (including Table 19-3), which may be considered the "core" of the chapter. Assuming that "key risks" rather than "key vulnerabilities" are crucial for informing interpretation of UNFCCC Article 2, the concept of key vulnerability could either be dropped at all (even though it is included in the chapter title) or the discussion could be restricted to what is necessary to identify key risks in Table 19-3. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The criteria for key risks and vulnerability have been modified. The revised version shows now clearly that key risks also encompass core criteria for key vulnerabilities as key risks are a product of hazards (severe hazards) and key vulnerabilities. For CC-KR and the presentation of key risks, the criteria for key vulnerabilities and key risks in 19.2 were applied by the various chapters that provided input. Hence, the key risks consider the criteria defined earlier.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
9	61458	19	0	0	0	0	Overall this chapter seems to be in good shape, and offers a useful synthesis of current and emerging knowledge of projected climate change impacts, vulnerabilities and risks, drawn from the literature and from other AR5 chapters currently in preparation. Confidence statements are usefully employed to communicate the strength of the evidence in question. Particularly interesting is the attempt to deal with the recursivity between policy actions to address climate change and the nature of related risks. However, some careful copy-editting is required - some particular examples are pointed out below. There is also a need for some conceptual clarification and empirical substantiation in places. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Thank you. We have done our best to copy edit and provide clarification where needed.
10	62070	19	0	0	0	0	I like the chapter draft. An excellent resume the post AR4 publish litterature. (Avelino Suarez, Institute of Ecology and Systematic, Cuban Environmental Agency)	Thank you.
11	62086	19	0	0	0	0	Risks can be altered by (1) changing the likelihood of physical impacts and (2) altering vulnerability and exposure. Yet, much of the attention in the chapter seems to be going to the first and much less to the second. (Joann de Zegher, Stanford University)	The discussion of differential vulnerability, different dimensions of vulnerability and the trends in vulnerability and exposure highlight the importance of vulnerability in determining risks linked to climate change. Thus through revisions of these discussions, we have further strengthened point #2 - changes in vulnerability and exposure are now clearly discussed and assessed.
12	62584	19	0	0	0	0	The chapter has 680 references, out of which 98 (14%) are from the chapter authors. (INDIA)	We are unsure what action is being requested.
13	62585	19	0	0	0	0	Out of these 680 references, only 15 (2%) are on developing countries. It is suggested that a more balanced approach could be adopted. (INDIA)	We appreciate the suggestion and we have tried to represent the relevant literature.
14	62586	19	0	0	0	0	A quick check on the total universe of articles in peer-reviewed journals since AR4 (2007) indicates that there are almost 1900 in journals of Science Direct, 800 in Francis and Taylor, 3300 in Wiley and 100 in JSTOR totaling to around 6100 articles in all on topic covered in this chapter. The chapter has captured almost 11% of existing literature. (INDIA)	See response to comment 12.
15	62587	19	0	0	0	0	Out of total 6100 articles mentioned as above, almost 3200 are on developing countries (around 50%) and issues related to them. It indicates that there is a large enough pool of articles to be picked up on developing countries to be cited in this chapter. The authors may like to take a look at it. (INDIA)	We have looked and tried to find articles relevant to the specific perspective of this chapter.
16	62593	19	0	0	0	0	Overall, emerging risks are assessed comprehensively. Very good presentation. (INDIA)	We appreciate your feedback.
17	62716	19	0	0	0	0	There many unclear descriptions on the base year for temperature rise (e.g., p.40 L.30-32; p.40 L.45-52; p.42 L.8). It confuses readers. The base year (1990, preindustrial, or others) should be clearly described. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	Thank you for this comment. We have carefully scrutinized the chapter and we believe that each reference to a temperture is now clearly labeled by a base year.
18	63671	19	0	0	0	0	In this chapter there is a bias on risk and hazard. Please always consider that climate change is effective not only by events but also by trends and their effects. That is also true for other stressors or non-climatic drivers. (GERMANY)	Trends are included in our hazard definition. However, we have also now in some cases added the word 'trends' to the word 'hazard' to ensure that the reader is aware that we capture both in the assessment.
19	63672	19	0	0	0	0	It is not necessary to differentiate between society and social-ecological systems or between humans and social-ecological systems. Instead always use social-ecological systems (which include humans and society). (GERMANY)	It is important to underscore that vulnerabilities and hazards might primarily impact societies, but also impact coupled systems - hence the term 'social-ecological systems' is used in order to underscore the point that even the degradation of ecosystem services will have severe consquences for social-ecological systems. Additionally, this differenciation is coherent with the discussion in the SREX report.
20	63673	19	0	0	0	0	Please delete the word hazard in the chapter and use climate change signals instead of hazard. The term hazard implies a normative judgment. (GERMANY)	Hazard is a standard term in the risk and impact literature. Climate change signal does not have a clear meaning related to impact.
21	63674	19	0	0	0	0	Please make always clear that in this chapter potential future impacts are meant in contrast to chapter 18 where measured impacts are meant. (GERMANY)	We try to be clear between past and future. However, some of the impacts we consider are indeed current or recent and not future.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
22	63675	19	0	0	0	0	This chapter should be re-structured, as it contains by far to many repetitions. As a reader you really get the feeling that you are confronted with same topics over and over again, only in slightly different contexts. It would be easier to understand and to follow, if you bundle all the important aspects with regard to health, agriculture, biodiversity in one respective section. The reader cares much more about sectors than about the more academic and conceptual questions if it is a key risk or an emergent risk or an emerging risk or a unique system etc...And all these issues are also discussed in other chapters, so you even have more repetitions. (GERMANY)	We disagree, specifically because the issues are discussed in other chapters, organized by sector or region. In chapter 19, those impacts need to be reorganized and analyzed according to different characteristics in order to interpret Article 2. The particular framing we use has a long history of successful use by the IPCC.
23	63676	19	0	0	0	0	In the whole chapter, the definitions of vulnerability, risk, hazard, impacts, etc. are not clear and used consistently. Therefore detailed comments are made for improving the definitions on page 8 . (GERMANY)	We improved the consistency of the use of the terms hazard, vulnerability and risk. This has also been done across chapters and within the glossary group.
24	66131	19	0	0	0	0	Presumably this table needs references for each entry (Martin Parry, Imperial College)	Many of the chapters have now provided us with lines of sight for each entry of what is now CC-KR. For those chapters that did not provide such information, the authors of Chapter 19 included representative lines of sight for each row.
25	66132	19	0	0	0	0	self citation: There are one or two places in this chapter where authors cite themselves as the only refs and where these refs are either forthcoming or submitted (eg Warren). Care is needed here, because it can lead to the impression that the authors are conducting their assessment, then working their assessment up for publication, so that their work provides the published source. You can avoid this by referring to the original source material (presumably published) used in the above forcoming analyses. (Martin Parry, Imperial College)	We appreciate the suggestion and have tried hard to broaden the literature cited where possible.
26	67885	19	0	0	0	0	This chapter describes on Reason for Concerning, which is hardly bring a clear conclusion due to social and scientific uncertainties. Therefore, the discussion on Decision Cycle in Chapter 2 should be taken into account in this Chapter. (JAPAN)	We are unclear on the meaning of this comment.
27	67886	19	0	0	0	0	Base year should be unified throughout this chapter. Though there is a sentence that "In this section, all warming scenarios are relative to pre-industrial levels unless otherwise noted" in 19.5.1, this seems to apply only to this section. For example, in page 5, line 42, page 40, line 8 and line 31 in the same page, no base years are shown. There is a large difference between, for example, 2 degrees Celsius increase since pre-industrialization and since some other year such as 1990. This difference has a huge policy implication for international negotiations. To avoid any misunderstandings, base year should be made clear enough. (JAPAN)	See response to comment 2.
28	67887	19	0	0	0	0	There are several cases where impacts are evaluated based on SRES A2 scenario. However, this scenario is rather unrealistic especially in population projection. Among 6 marker scenarios, projection of world population is the highest. For example, in A2 scenario, world population is projected to be 11 billion in 2050 and 15 billion in 2100 (ref. p. 363 in SRES). On the other hand UN mean population projection in 2050 is 9 billion. Thus impact based on A2 scenario tends to be higher than the one based on other scenario. Another point is that global emissions and temperature increase in 2100 are the highest in A2 scenario (ref. Figure SPM.5 in page 7 of the synthesis report of AR4). In that sense, in citing impact figures based on A2 scenario, some kind of note should be accompanied in order not to mislead readers. The followings are examples; 1) Page 18, line 6; 2) Page 21, line 1; 3) Page 26, line 40; 4) Page 36, line 52 (JAPAN)	see response to comment 3
29	71412	19	0	0	0	0	While this chapter focuses on detailing key emergent risks and vulnerabilities as identified in empirical and model-based studies, it would benefit from some added content. For example, a new section could provide a brief review of different quantitative measures for risk and vulnerability as applied to address climate change issues. A summary of different ecosystem modeling methodologies would also be very helpful as they span a wide range of parameter and structural complexity and have very different levels of sensitivity and overall predictive accuracy and sensitivity, despite inputting the same climate scenarios. Also, the difference between estimation and prediction/forecasting needs to be explained in terms of how model and data-based uncertainty are factored in. (CANADA)	In general one could add a larger section on quantitative measures to assess risk and vulnerability, however, this would increase the length of the chapter significantly. Literature that is dealing with such quantitative assessments is cited, e.g. Welle et al. 2012, de Sherbini 2013 etc.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
30	74164	19	0	0	0	0	If this chapter is infact tied to the UNFCCC's Article 2 as tightly as the authors imply, then all of the risks include in this chapter must be able to be attributed to anthropogenic climate change. We do not believe this standard has been rigorously applied across the chapter and its discussion of risk and must be addressed in the next draft. In that regard, confidence levels and the evidence basis for assigning these confidences must be included to provide real value for the reader. (UNITED STATES OF AMERICA)	The attribution of risk to anthropogenic climate change has been sharpened. However, it is also important to note that changes in climatic conditions or extreme events do not constitute a risk. Per definition and in the scientific literature there is a very high confidence that risks are only constituted if climate change or climate variability interacts with the vulnerability of an exposed system. Heat waves, floods, droughts, temperature rise are hence solely hazards.
31	74165	19	0	0	0	0	Several of the figures could be eliminated: Figure 19-1 can't be accurate if the definition of key risk is tied to the UNFCCC and therefore to anthropogenic climate change per the definition on pg 8. Pick either 19-3 or 19-4 to capture the message for ocean acidification, not both. 19-6 is very difficult to understand, dated (based on SRES) and should be deleted. (UNITED STATES OF AMERICA)	We disagree with respect to the accuracy of Figure 1. As stated in the text, both climate change and climate variability affect risk, vulnerability and exposure. While for purposes of addressing the concerns of Article 2, only anthropogenic climate change is (by definition in UNFCCC) of direct interest, this chapter must also set the broader context for determining what is dangerous. As noted in the chapter and the figure caption in particular, hazards shape vulenrability and exposure to some degree, which then interact with anthropogenic climate change. Furthermore, anthropogenic climate change adds to natural variability in interacting with vulnerability to create risk. While all these connections cannot be clearly elucidated by a figure, the figure does broadly reflect the key ideas presented in the chapter and is an important means to convey the important messages. Thank you for the suggestion on the figures -Figure 19-4 has been deleted. However, we disagree about Figure 19-6: it is not "based on SRES" but uses SRES for illustrative purposes because RCPs do not work well to make the point.
32	74166	19	0	0	0	0	Several of the key findings statements on pages 3-4 do not have any confidence level attached to them. This makes it confusing to the reader especially for emerging areas in the literature (e.g., patterns of violence as a risk). In addition, although the chapter is focused on risks and vulnerabilities, the authors could have discussed some of the related opportunities and ways of reducing vulnerabilities that might lesson some of the risks. Overall, the chapter is heavy on the doom/gloom aspects. At a minimum, the chapter could point to places in other chapters that discuss opportunities (e.g., for different sectors, communities) and adaptation pathways that could diminish future risks. (UNITED STATES OF AMERICA)	We inserted where appropriate more confidence statements in the assessment.
33	74167	19	0	0	0	0	The Executive Summary does include some important bullets and conclusions; however, understanding this material does depend in large part on how familiar the reader is with the definitions used (e.g., those presented beginning on page 8). Is there a way to present these in a box in the Exec Summary? (UNITED STATES OF AMERICA)	To address this issue, we have inserted a reference to Box 19-2 at the first use of new terminology in the executive summary.
34	74168	19	0	0	0	0	There are a number of instances where the phrase "is a risk emerging in the literature" is used to refer to emergent risk (e.g., Page 3, line 46). This is not quite phrased properly; suggesting changing this and other instances to "is an emergent risk recently identified in the literature" (UNITED STATES OF AMERICA)	For the FGD, we have refrained from using the term "emerging" in this chapter, except for specific instances in which we discuss health sector-related material. We have replaced "emerging risk" with "newly identified risk."
35	74169	19	0	0	0	0	There is not enough discussion on the adaptation to emergent risks and vulnerabilities. An example is local, organic and alternative farming practices could have a positive effect on risks and vulnerabilities. (UNITED STATES OF AMERICA)	Adaptation issues have now been strengthened, for example limited capacities of adaptation are discussed in the assessment of key risks and key vulnerabilities.
36	74170	19	0	0	0	0	This chapter is a bit dense and difficult to read, at times, and some sections seem a bit repetitive. The terminology utilized ("emergent" and "emerging") is somewhat confusing and not consistent with the ways these terms are used, for example, in the health sector. (UNITED STATES OF AMERICA)	Please see comment 34.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
37	74171	19	0	0	0	0	Throughout the chapter and particularly in the chapter summary, there are statements that "risk is increasing" due to one thing or another. We find little illuminating content in such a statement, often provided without a confidence statement. Even where confidence statements are provided, the evidence base is not cited and the reader is left to wonder which statements are the author's judgement or opinion and which have a strong evidence base. We recommend changing the statements as much as possible to quantitative measures of impact on human and natural systems and indicating the evidence base. The IPCC should avoid the use of unsupported, speculative language. (UNITED STATES OF AMERICA)	This is a valid point, and to the extent possible, we have tried to focus on level of risk rather than whether it is increasing or decreasing, with quantification where possible. However, quantititive measures are not always available. That is one reason why confidence rather than likelihood language is used. Furthermore, chapter 19 is devoted partly to development of general concepts which facilitate implementation of Article 2, so some degree of non-specificity is actually desirable.
38	77690	19	0	0	0	0	Overall, I think this chapter is in good shaped - I enjoyed reading it, and learned quite a lot. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you.
39	77691	19	0	0	0	0	A general comment is that the authors should review their use of the IPCC uncertainty language in the chapter. Quite a few of the assessments are given using likelihood language, often in circumstances where it would be difficult to precisely articulate how the event that is being assessed is defined. That in turn, then makes it difficult to determine a probability (likelihood), since the boundaries that define the event would be subject to interpretation. In these circumstances, perhaps confidence language would be more appropriate. (Francis Zwiers, Pacific Climate Impacts Consortium)	We appreciate the suggestion and have made a strenous attempt to eliminate uses of "likelihood" language which are not in accord with the uncertainty guidance.
40	77692	19	0	0	0	0	A further general comment is that the chapter sometimes lapses into a mode of presentation where it is reporting things that are found in the literature, but not providing critical assessments of the findings. I think in all cases, it should attempt to provide an assessment (even if the use of the uncertainties language does not seem appropriate), for example, giving the reader guidance on caveats that might affect the robustness or interpretation of the results that are described. (Francis Zwiers, Pacific Climate Impacts Consortium)	For the FGD, we have worked to eliminate this issue both by focusing sections on critical assessments and by cross-referencing material already covered in other chapters of WGII.
41	78250	19	0	0	0	0	Both chapters 12 and 19 cover the issue of climate change and conflict, however in very different and inconsistent ways. Chapter 12 provides a more balanced account of the literature and the range of positions expressed there. The assessment of the literature in Chapter 19 is more unbalanced and rests much on two unpublished articles by one of the contributing authors that takes a very determined position. The IPCC should provide a fair account of the different positions expressed in the peer-reviewed literature. The division on this subject in the research community has been made explicit in a recent commentary in Nature (Solow, 2013, Nature 497: 179). Chapter 19 does not refer to primary articles that are more cautious about the climate-conflict link which have been also quoted in the mentioned Nature commentary. (Jürgen Scheffran, University of Hamburg)	Chapter 12 and chapter 19 now have consistent presentations. They are, however, different in that Chapter 19's purpose, explicitly stated, is not to repeat the presentation in chapter 12 except by reference to it, but to focus specifically on evidence about the potential magnitude of the relation between climate and conflict. We are careful to cite articles indicating the disagreements in the literature and to cite low and medium confidence in some findings as a result. However, the two author teams have discussed this issue in depth and believe the presentations are now consistent and complementary.
42	79973	19	0	0	0	0	This comment is about the lack of discussion about diet change. In chapter 19, it is mentioned a number of places, for example on page 20 line 20, page21 line 32, page 22 line 6-18 and page 78 note (i) that, besides increased production of biofuel, also (NORWAY)	Truncated comment. We are thus unable to identify the requested action.
43	80140	19	0	0	0	0	Emergent risks are very interesting and innovative. Some components of emerging risks overlap with sector-based chapters (e.g. ocean). Parts of key vulnerabilities, key risks,maladaptation, and limits to adaptation sections overlap with some of the sections in adaptation chapters.migration and conflicts/insecurity overlap with the human security chapter. If it is suitable, overlaps could be reduced and new topics such as emergent/emerging risks could be expanded. (So-Min Cheong, University of Kansas)	Thank you for this comment. We have tried to further reduce overlaps.
44	80526	19	0	0	0	0	This chapter covers an enormous amount of ground and the authors have done an impressive job in drawing so much material together – I congratulate them. Nevertheless there are some sections of this draft which are still weak (in terms of limited or partial evidence in support of confidence statement) and these need to addressed, either with improved coverage of evidence or revisions to confidence statements. There are also a number of cases where the text in this chapter appears to be either inconsistent with other chapters - I have noted this for Chapters 4 and 12 in particular. I suggest further cross-chapter working for the FGD. I give specific suggestions in my comments later, which I hope are helpful. (Richard Betts, Met Office Hadley Centre)	Thank you for these suggestions, which we will carefully consider.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
45	80527	19	0	0	0	0	There are a number of references to impacts above 2C global warming. While this is clearly relevant to policy, since both EU policy and the Copenhagen Accord focus on the 2 degree target, I think it is important that this chapter is very visible in taking an objective view and does not give the impression of simply finding reasons to back up the 2 degree target (it does come across like that in some places - eg. the last sentence of the caption for Figure 19-5, and page 4 lines 52-54 in the ES). (Richard Betts, Met Office Hadley Centre)	Caption of figure 19-5 (now 19-4) has been rewritten and the passage eliminated. The mention of 2-degrees remains in the ES, but we think it is entirely appropriate since it reflects the underlying literature. In other rpesepcts, we have tried to avoid "policy presciptive" tone in regard to two-degress but do not that this value does have a speical status within the UNFCCC and countries are interested in risk in relation to this value.
46	80940	19	0	0	0	0	The chapter team may consider moving the definition box closer to the introduction as several of the ES findings are using concepts that are new for the readers. (Monalisa Chatterjee, IPCC WGII TSU)	A reference to the definitions box (Box 19-2) has been inserted at the first use of new terminology.
47	80941	19	0	0	0	0	The applicability of key vulnerability or key risk criteria are not clear. The author team may briefly highlight what aspects of specific risk and vulnerability push them into the key risk and vulnerability category. (Monalisa Chatterjee, IPCC WGII TSU)	The differentiation of criteria for key vulnerabilities and key risks has been improved. The criteria were also applied for example by other chapters in terms of the provision of input for CC-KR.
48	80942	19	0	0	0	0	There is limited mention of adaptation issues in the excutive summary. (Monalisa Chatterjee, IPCC WGII TSU)	There are now 12 references to adaptation in the ES.
49	81046	19	0	0	0	0	There are some missing/ incorrect citations in the chapter. These discrepancies have been highlighted in the ref check document for chapter 19 and is available in the supporting material web page. Chapter team may wish to rectify these errors before starting to work on SOD revisions and FGD preparation. (Monalisa Chatterjee, IPCC WGII TSU)	The references section has been completed for the FGD.
50	82949	19	0	0	0	0	1) Overall -- The chapter team has prepared a very strong second-order draft. In preparing the final draft, the chapter team should recognize the important role this chapter plays in tying together assessment across the report, with framing central to the report's narrative. Given this, the chapter team should aim to make its assessment advance beyond the 4th assessment report as much as possible. Beyond the new emphasis on risks (key, emerging, emergent), to what extent can further advance be made in the utility and graphical representation of the assessment? For example, the criteria for key risks reflect core information relevant to risk management. But in the summary presentation of key risks, the chapter team does not make explicit the relative importance of these criteria for each risk. To maximize the traction of the chapter, I wonder if there are opportunities for presenting further nuanced information, for example as relevant to these criteria, in the summary statements and graphics of the chapter. (Katharine Mach, IPCC WGII TSU)	The challenge is that a variety of the criteria for key vulnerabilities and key risks apply to the presented key risks and key vulnerabilities in the text and the table. We could add for example sentences on how certain examples are linked to the irreversibility or the presistence of vulnerability, but this would increase the length of the table or the bullet points in 19.6 significantly.
51	82950	19	0	0	0	0	2) Condensing the assessment -- Chapter 19 has the potential to be a chapter that, once started, cannot be put down. To get there, it needs to be 10 pages shorter in the main body of the chapter text. Opportunities for shortening, tightening, and refining are especially relevant in sections 19.3 through 19.6. Through providing further cross-reference to the assessment and findings of other chapters in the report, these sections could be shortened and simultaneously better integrated and harmonized with the report as a whole. Where cross-references are made to other chapters, they should be as specific as possible, referencing relevant chapter sections and findings. Another strategy for refinement is to ensure that each topic is hit fully in only one place within chapter 19, with any other discussion of the same topic simply cross-referencing, briefly, that assessment. (Katharine Mach, IPCC WGII TSU)	Thank you for your encouragement. We believe we have succeeded in all the ways you recommend, except shortening.
52	82951	19	0	0	0	0	3) Priorities for coordination across the report -- Given chapter 19's role as a synthesis chapter in the report, coordination is especially important. 4 priorities for coordination jump out to me: 1) Handoffs with working group 1 should be refined especially carefully. 2) Assessment of reasons for concern currently occurring in chapter 18 should be fully harmonized with the approach taken in chapter 19. There seem to be substantial opportunities for refining the handoffs between chapters 18 and 19 on reasons for concern. 3) Impacts at 4°C are summarized primarily, of course, within chapter 19, although they are relevant across the sectoral and regional chapters. To fully support substantive treatment of this material within the summary products for the report, the chapter team is encouraged to continue its cross chapter coordination efforts for this material fundamental to the framing of managing risks. 4) Hotspots are also primarily summarized within chapter 19, although touched upon with a variety of different definitions and approaches in other chapters. The chapter team is also encouraged to provide rich and coordinated summary of hotspots, further harmonizing this treatment across the report. (Katharine Mach, IPCC WGII TSU)	Cooperation with other chapters has been intensified, e.g. regarding input for CC-KR, and especially with chapters 4, 7, and 18 in developing KRs and RFCs.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
53	82952	19	0	0	0	0	4) Characterization of risks -- At the summary level, chapter 19 is generally characterizing specific key, emergent, and emerging risks in a way that does not show how risks increase with level of climate change or, broadly, how effectively risks can be reduced through mitigation and adaptation. The current presentation could be interpreted to imply inevitability of risks or to downplay overly where choices are relevant in reducing risks. In characterizing risks, at a level of specificity that is supportable, the chapter team should further consider indicating the extent to which risks can be reduced through mitigation, adaptation, or other responses. That is, is it possible to indicate how risks may increase as the level of climate change increases or, potentially, to indicate the relative importance of changes in mean conditions, as compared to changes in extreme events, as compared to potential non-linear changes associated with biome shifts or tipping points? And then, how much can risks be reduced through adaptation or development, in the near-term and the long-term? How are factors or stressors that multiply risks relevant in this context? As supported by its assessment of the literature, the author team should consider communicating risks for the era of climate responsibility (the next few decades, for which projected temperatures do not vary substantially across socio-economic/climate scenarios) and for the era of climate options (the 2nd half of the 21st century and beyond). (Katharine Mach, IPCC WGII TSU)	The differentiation of hazards, key vulnerabilities and key risks is already a major improvement for effective risk management and adaptation as well as mitigation, since it shows what kind of aspects need to be addressed within risk reduction and adaptation measures. Furthermore, the text and the table (eg. CC-KR) underscores the importance of local, national and international risk reducation and adaptation strategies, for example the inadequate or missing implementation of risk reduction measures is named as one core factor or characteristic of a key vulnerability in CC-KR (thus agreed also by various other chapters). Section 19.7 now provides a comprehensive and quantitative examination of reduction of risk via mitigation.
54	82953	19	0	0	0	0	5) Graphical depiction of reasons for concern -- The chapter team is strongly encouraged to consider new visualizations of the reasons for concern. That is, is there a way to incorporate some of the elements from figure 19-6 into the main RfC graphic (figure 19-5) in a way that can be supported by the chapter's assessment? One option would be to take the approach of figure SPM.5 displaying each RfC within a "wedge" with risk depicted in the near and long term. The potential for adaptation to reduce risk and the ways risks vary with increasing level of climate change could be depicted. As a reference for the chapter team, the TSU is preparing a potential mock-up of this concept for the chapter team to consider. (Katharine Mach, IPCC WGII TSU)	We have modified the Burning Ember diagram in several ways, including to a limited degree the issue of limits to adaptation. I'm afraid that within this particular framework, this is all the literature allows at the moment.
55	82954	19	0	0	0	0	6) Parenthetical presentation of calibrated uncertainty language -- To make statements throughout the chapter as concise and accessible as possible, the chapter team should further consider presenting calibrated uncertainty language within parentheses at the end of statements, as already done in many places throughout the chapter. (Katharine Mach, IPCC WGII TSU)	We have revised the chapter to take up this recommendation in nearly every instance.
56	84345	19	0	0	0	0	GENERAL COMMENTS: I congratulate the author team for a well-written and informative SOD and an effective executive summary. Please see my detailed comments for suggestions related to traceable accounts for ES findings, cross-chapter coordination (particularly with Chapter 18 related to 19.6.3), reducing overlap across sections (in just a few cases), refining figures and tables, calibrated uncertainty language, and various specific clarifications. I have one general comment on the chapter. The ES presentation of emergent and key risks focuses on identifying topics/specific interactions. This is very useful information, but I was left without a sense of the extent to which these risks might be managed: the timing of when they might materialize (near term vs. long term), their (in)sensitivity to climate/socioeconomic pathway, the potential or lack of potential for mitigation and adaptation to reduce them, etc. The conclusions coming out of 19.7 get at some of this in more general terms, but these details are relevant to the criteria presented for identifying key risks. Further characterization of such details, to the extent supported by the literature, would be helpful in understanding potential responses to these risks. In addition, this information would help provide the basis for the proposed Figure 19-10 that relates impacts at various levels of temperature increase to categories of mitigation scenarios. (Michael Mastrandrea, IPCC WGII TSU)	To the limited extent feasible, this approach has been taken up, particularly in 19.6.3. However, given the tie to future development pathways and the immature nature of the SSPs, we really can't go to far in this direction in AR5, other than the schematic approach in Figure 19-5.
57	84346	19	0	0	0	0	SUMMARY PRODUCTS: In preparing the final draft of your chapter and particularly your executive summary, please consider the ways in which your chapter material has been incorporated into the draft SPM and TS. For chapter 19, this includes presentation of determinants of risk and impacts in sections A.i and B.i, key and emergent risks in section C.ii, consequences of large magnitude climate change in Box SPM.5/TS.6, anthropogenic interference with the climate system in Box SPM.6/TS.7, development pathways and limits in section D.i and Box SPM.7/TS.10, and figures and tables associated with these sections. Are there opportunities for presenting chapter findings and material in a way that further supports broad themes highlighted in the summary products and that facilitates additional cross-chapter synthesis in specific findings or figures/tables? Do the existing summary product drafts suggest additional coordination that should occur between Chapter 19 and other chapters at LAM4? (Michael Mastrandrea, IPCC WGII TSU)	We believe we have moved well along in this direction.
58	85219	19	0	0	0	0	How long can you keep this up? I want my dinner (Vincent Gray, Climate Consultant)	This comment is irrelevant.
59	57636	19	2	3	50	7	Conclusions should be bold. "This is what the chapter does" should not. (Same error repeated at other points in the summary.) (Richard S.J. Tol, Vrije Universiteit Amsterdam)	We now do a better job in this regard. Thanks.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
60	71394	19	2	9	2	9	Suggest inserting "Key" before "Emerging Risks" as per section 19.6 which is named "Key Vulnerabilities, Key Risks and Reasons for Concern" (CANADA)	By our definition, emerging risks are not yet key, but have the potential to become key.
61	71395	19	2	9	2	9	Suggest inserting the current section 19.5 within the Key Risks 19.6.2 subsection of section 19.6. (CANADA)	We appreciate the idea but after consideration, we conclude that material in 19.5 is properly placed. The new title may help.
62	68117	19	2	48	0	0	The confidence level should be given to conclusions in the ES, while no description of confidence is found in the text. It is suggested to make an addition according to the Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties (6-7 July 2010). (CHINA)	The chapter has been edited carefully to ensure that confidence language appearing in the ES is consistent with and rooted in the main text.
63	68118	19	2	48	0	0	The ES is too lengthy. It is suggested to reduce it by simplifying the three parts of L8-34 on P3, L31-44 on P4 and L52 on P4-L36 on P5, which are given in the form of "keyword and [citation]". For example, P3L8-34 is suggested to read: "For example, the risks of climate change to human and natural systems, particularly high in large urban & rural areas in low-lying coastal zones[19.3..2.4], by the loss of ecosystem services supported by biodiversity[19.3.2, high confidence], increasing or decreasing regional ground water resources[19.2.2.2, high confidence], …." (CHINA)	We tried several approaches to shortening the ES but in the end, did not succeed in doing so. The overview nature of the chapter got in the way of the generally sensible objective of shortening.
64	82955	19	2	48	0	0	Nuanced Characterization of Risks -- For key, emergent, and emerging risks characterized within the executive summary, the chapter team should consider ways to frame the risks with agency, not inevitability, to best inform decisions relevant in the context of Article 2. That is, how do risks increase with the level of climate change, how do they differ in the near term and the long term, how much can the risks be reduced through adaptation, etc.? The reader understands that the chapter team has assessed relevant aspects, for example through the 4 criteria for identifying key risks, but the reader doesn't necessarily understand which criteria are most relevant for each risk summarized. It would seem ideal for the executive summary to further emphasize, through its framing for summarizing risks, the degree to which risks can be reduced through proactive adaptation versus mitigation. (Katharine Mach, IPCC WGII TSU)	Some of this material is now found in the chapter, particularly 19.6.3; but given the comment above in regard to the unavailbility of SSPs, we are quite limited in what we can do in this regard.
65	66298	19	2	50	2	52	This formulation suggests that a set of ingredients are being combined with the purpose of "producing" risk. I think it would read better if risk (the outcome of interest) is introduced first, before describing the various ingredients predisposing these systems to risk. Hence, this could read: "In the context of Article 2 of the UN Framework Convention on Climate Change, this chapter assesses climate-related risks that emerge as a function of the evolving exposure and vulnerability of human, socioeconomic and biological systems and of changing physical characteristics of the climate system. Alternative ...." (Timothy Carter, Finnish Environment Institute)	Sentences rewritten, although not precisely as recommended.
66	61459	19	2	50	2	53	The sentence in bold isn't wholly clear, particular the phrase "the interaction of… to produce risk". Perhaps re-word to "the potential of the interaction of… to produce risk" (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This sentence has been edited for clarity.
67	61460	19	2	50	6	3	The Executive Summary seems to cover the most important points raised in the chapter. However, there is a need for consistent application of confidence statements in the summary. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have worked to make confidence language use consistent within the ES as well as between the ES and the main text.
68	62084	19	2	50	6	3	It would be very useful to have the definitions of key vulnerabilities, key risks, emergent risks and emerging risks somewhere upfront in the executive summary rather than only on page 8. Without an understanding of what these terms mean, the reader might tend to glance over many of the words in the Executive Summary and miss the significance of what is being said. (Joann de Zegher, Stanford University)	Doing so would be rather complicate due to the fact that these definitional issues cover a complex field or complex phenomena. We have, however, addressed this issue by referring to Box 19-2 at the first use of new terminology in the executive summary.
69	59045	19	3	0	6	0	Once again, more attention should be given to the usages of terms "climate change", "anthropogenic climate change", "climate", "climatic hazards" and "climate change-related hazards". It is better to use "anthropogenic climate change", and "anthropogenic climate change-related hazards". In case that this is not possible, a clear statement about the differences among the terms should be given. (Guoyu Ren, National Climate Center)	This is a thorny issue which is clarified in Chapter 18. We prefer to leave it to that and simply note the distinction where it has a singificant bearing on the specific text.
70	78893	19	3	2	3	7	The bold statement is a descriptive of the chapter, not a finding of the chapter. A more appropriate actual finding to be bolded would be the first non-bold statement. If you feel the narrative is necessary, move the current bold sentence into the first para of the executive summary (on page 2). (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	This sentence has been rewritten to provide a finding of the chapter rather than a descriptive.
71	57637	19	3	2	3	34	How can there be high confidence in an emergent risk? Either the literature is sufficiently established to permit high confidence or the risk is emergent and the literature premature. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Good point!

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
72	57792	19	3	2	3	34	All the examples are of the same sign of change - adverse impact. In some cases, positive impacts seem equally likely. The bullet statements are all true, just slanted in my opinion. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The remit of this chapter, Article 2, presumes a focus on the negative.
73	74172	19	3	2	3	34	The chapeau to this paragraph is very confusing. Please clarify. (UNITED STATES OF AMERICA)	The chapeau has been reworded.
74	77693	19	3	7	3	7	It's not clear to me what is assessed to have high confidence. (Francis Zwiers, Pacific Climate Impacts Consortium)	Confidence language removed.
75	74173	19	3	8	3	34	Some of the bullets have a confidence level associated with them and some do not - please consistently apply confidence across all of these (UNITED STATES OF AMERICA)	Each bullet now has confidence language.
76	74174	19	3	11	3	11	The systemic risk isn't necessary "new" in all case; suggest rephrasing to "enhancing existing and generating new" (UNITED STATES OF AMERICA)	This text has been removed.
77	57790	19	3	15	3	18	The meaning of this bullet is unclear. The sentence needs reworded. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This bullet has been revised.
78	77694	19	3	17	3	17	I think this type of statement (climate change could cause a change, either up or down) should be avoided if at all possible. It's obviously true, but without more specifics (e.g., as to the places involved and convincing arguments about why there would be increases in some regions and decreases in others), it comes across as being trite, and would be easy to deride. (Francis Zwiers, Pacific Climate Impacts Consortium)	This wording has been removed.
79	74175	19	3	19	3	19	Not all climate change impacts on human health are adverse (UNITED STATES OF AMERICA)	The wording of this phrase has been revised according to the suggestion.
80	77695	19	3	19	3	19	An epidemiologist might agree, but a healthy individual who has not been affected might disagree. Suggest inserting "has the potential to" ("Climate change has the potential to affect human health"). Such a formulation would also recognize that some of the risks are being mitigated (e.g., through the implementation of heat alert systems and heat shelters for those at risk, improved warning and evaculation procedures for those living in some areas affected by tropical cyclones, etc.) (Francis Zwiers, Pacific Climate Impacts Consortium)	The wording of this phrase has been revised according to the suggestion.
81	60104	19	3	19	3	22	Comment relates to human health impacts from exposure to extreme weather events. This could also refer to a reduced incidence of cold-related impacts through less incidence of very cold days (AUSTRALIA)	This passage has been reworded in a way which we believe eliminates the case for implementing this suggestion.
82	84347	19	3	21	3	22	The effects on mental health of population displacement are not covered in 19.3.2.3. (Michael Mastrandrea, IPCC WGII TSU)	This has been removed from the bullet.
83	57791	19	3	23	0	0	"new interactions" - This is unclear what is meant. More words are needed here. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This wording has been removed.
84	70739	19	3	23	0	0	the last word in the line "interactions" should be specified (what kind of interactions and with what). It is clear that the examples will provide clarity, however this should be clarified from the general perspective as well (Stefan Kienberger, University of Salzburg)	This wording has been removed.
85	79082	19	3	24	3	26	This valuation seems to contradict statements in Chapter 18. Please check with the other authors for onsistency. It may be advisable to reference the other sub-chapter and explicitly show differing points of view. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	We are unable to find the referred-to contradications. In any event, this bullet deals with the future while chapter 18 deals with the recent past.
86	84348	19	3	27	3	30	The Sub-Saharan Africa example is covered in 19.5.1, which should be added to the line of sight. (Michael Mastrandrea, IPCC WGII TSU)	The mention of Sub-Saharan Africa has been removed from this bullet point, thus this line of site is no longer necessary.
87	69446	19	3	30	3	30	A reference to paragraph 19.5.1. is needed - this is the paragraph in which Africa's case as a hotspot is discussed. (NETHERLANDS)	See comment 86.
88	84349	19	3	31	3	34	The very short section 19.3.2.5 does not really provide support for this bullet (including the example presented here). The section refers to the discussion of these topics in Chapter 14, but if the author team wishes to make this a finding of Chapter 19, I would suggest including a discussion of the basis of the confidence assignment and the provided example in 19.3.2.5. (Michael Mastrandrea, IPCC WGII TSU)	Section 19.3.2.5 has been deleted.
89	80551	19	3	34	3	34	The Exec Summary should also highlight risks potentially arising from certain mitigation actions as discussed later in the chapter, eg: bioenergy and its impacts on ecosystems. (Richard Betts, Met Office Hadley Centre)	These risks are now highlighted in the ES.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
90	57638	19	3	43	3	45	Alarmist focus. The impacts of climate change on migration are generally found to be pretty minor, but of course when you zoom in on a particular place and time, anything looks big. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This language is consistent with Chapter 12. Furthermore, since our objective is partly to look at distribution of impacts, evaluating risks related to migration at specific locations and times is certainly a central objective for chapter 19.
91	70740	19	3	46	3	48	As this is still a hotly debated issue in the literature, words should be used carefully and also this 'uncertainty' mentioned. Additioanlly it may be an option to add beyond general climate change, also the changed frequency of climate change induced extreme events as well as possibly changed socioeconomic patterns. (Stefan Kienberger, University of Salzburg)	Thank you for these suggestions. We have carefully vetted the new language on this point with chapter 12 and we think the bullet is now cautious, accurate, and precise in reflecting the underlying section in chapter 19 and the literature.
92	57793	19	3	49	3	51	Is this really an emergent risk? I thought several past IPCCs made this point. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have clarified definitions: emergent means complex from the system dynamics persepctive, not emerging (new).
93	84350	19	3	49	3	51	The last sentence of this bullets on tracking climatic changes and extinction is not explicitly covered in section 19.4.2.3, and it would be useful to discuss this point more directly. (Michael Mastrandrea, IPCC WGII TSU)	This point has been removed and the bullet has been revised to better represent the main findings of 19.4.2.3.
94	57639	19	3	50	3	51	The sentence "Where range … extinction." is logical: It is either true or false. The expressed confidence in this logical statement is a reflection of your self-assessed ability to perform logic? (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This sentence has been deleted.
95	57795	19	4	2	4	4	SRM phrase - delete - There are all sorts of geoengineering "solutions". Why focus on SRM here? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This bullet point has been revised and SRM is now discussed as one example of geoengineering.
96	63677	19	4	2	4	4	Wording implies that SRM technologies are already at hand. Please reformulate, e.g.: “…and the risk of adverse regional impacts arising from p o t e n t i a l Solar Radiation Management…” (GERMANY)	This bullet point has been completely rewritten, and while the exact wording suggestion from the reviewer was not implemented, the revision is in alignment with the reviewer's suggestion.
97	71396	19	4	3	4	4	Suggest being more specific/clarifying the adverse impacts here/upfront for readers regarding the "...adverse regional impacts arising from Solar Radiation Management implemented for the purposes of limiting global warming". Suggest inserting "(e.g., stratospheric aerosols and marine cloud brightening)" after "Solar Radiation Management" as per details contained in 19.5.4 (CANADA)	This bullet has been completely rewritten and potential adverse impacts are now listed.
98	57640	19	4	6	4	9	Empty statement. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This sentence has been removed and the bullet on large temperature rise has been completely revised.
99	71493	19	4	6	4	9	Apart fron the exceedence of human physiological limits, the authors could consider to emphasise that in certain warming scenarios, losses could exceed human society’s ability to manage said impacts. Warming above +4°/+5°C could result in serious consequences for i.e. weather-related insurance concepts. See for example: Stern, N. (2007): The Stern Review: The Economics of Climate Change. Cambridge. Warner et al (2012): Insurance solutions in the context of climate change-related loss and damage: Needs, gaps, and roles of the Convention in addressing loss and damage. Munich Climate Insurance Initiative (MCII) submission to the SBI Work Programme on Loss and Damage, October 2012. Policy Brief No. 6. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS). (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))	In section 19.6.3, we specifically take up the question of limits to adaptation in a more general sense, as indicated in the related sections of our ES.
100	74176	19	4	7	4	7	The exceedence of human physiological limits appears to be an impact based on a single citation (see Page 27, line 27) but it is given some degree of prominence here in the Executive Summary as well as in the Technical Summary chapter. Because this is a rather stark impact associated with climate change, several citations may provide more confidence to the reader, if it is to be given such prominence. (UNITED STATES OF AMERICA)	The point has been removed from the ES at the reviewer's suggestion.
101	57618	19	4	7	4	8	“Key risks associated with large temperature rise include exceedance of human physiological limits in some locations and nonlinear earth system responses (high confidence).”As a major conclusion,this sentences should be marked by black. (GE GAO, National Climate Center,China)	This point has been removed from the ES.
102	57794	19	4	8	0	0	nonlinear earth system responses - can you give an example or 2? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We reworded this section for clarity.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
103	77696	19	4	8	4	8	I think another term is required in place of "non-linear earth system responses", or at least, an example is required, so that the meaning of the term is not left entirely to the imagination of the reader. What about saying like "and traversing thresholds that may lead to disproportionately large earth system responses, such as irreversible melting of the Greenland ice sheet". I realize that this is a lot more words, but different readers will imagine very different things when confronted with the word "non-linear". (Francis Zwiers, Pacific Climate Impacts Consortium)	The phrase 'non-linear earth system responses' has been reworded in accordance with the reviewer's suggestion.
104	57796	19	4	8	4	9	other stuff not studied - This is a motherhood statement. Delete or add much more. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This wording has been removed.
105	84351	19	4	8	4	9	The statement that there may also be key risks in other sectors and regions that have not been studied in the context of temperature increase >4C is not really discussed in 19.5.1. It would also be useful to clarify this statement a bit further--does this mean that in those other sectors/regions impacts have been studied only for lower levels of temperature increase? (Michael Mastrandrea, IPCC WGII TSU)	This wording has been removed.
106	74177	19	4	11	4	11	Add "regional" to "Global and local socio-economicåÉ" (UNITED STATES OF AMERICA)	Regional' has been added.
107	57641	19	4	11	4	16	"dynamic and thus varying across temporal and spatial scales" Dynamic means varying over time, rather than varying over temporal scales. Space, let alone spatial scales, has nothing to do with it. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	While dynamic does mean varying with time, the nature of the climate problem is such that vulnerability and exposure vary across temporal and spatial scales partly because these features vary with time. The complex interactive nature of these factors guarantees this. We thought this phrase provided a direct way to appropriately link the three concepts.
108	82956	19	4	11	4	19	Could calibrated uncertainty language be assigned for the findings in bold in these paragraphs? (Katharine Mach, IPCC WGII TSU)	Confidence statements have been inserted for these points.
109	61461	19	4	13	4	15	"the vulnerability and exposure of people" - the sentence feels incomplete, particularly as "exposure" is yet to be defined. Could "to risks" or similar be added? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We think the language is clear within the context.
110	70741	19	4	15	16	0	delete "race"; ethnicity should be sufficient; next to changes in governance, the 'weakness' of governance could be added (Stefan Kienberger, University of Salzburg)	Race has been deleted here, but felt that the language around governance was clear.
111	84352	19	4	16	4	16	Section 19.6.1.1 also supports this paragraph. (Michael Mastrandrea, IPCC WGII TSU)	We have changed the line of sight to 19.6.1. to include all of the relevant subsections.
112	74178	19	4	18	4	22	Climate change is the least of the problems of a failed state. While climate change may worsen conditions, in many cases, it is not the source problem. It may only be a matter of tone, but these lines seemed to trivialize the problems of a failed state. (UNITED STATES OF AMERICA)	We disagree. This statement seems to us like a straightforward summation of the literature indicating that governance failure creates difficulties for reducing vulnerability. Nowhere do we imply that climate change is among the key problems for failed states; we did not investigate the latter question.
113	82957	19	4	20	4	22	"high confidence" could be placed within parentheses at the end of the statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	The confidence language has been moved according to the reviewer's suggestion.
114	74179	19	4	29	4	44	This list of key risks follows three previous lists of risks (P. 2, lines 2-34; P. 2, lines 36-51, P. 3, lines 1-24 and prompts us to wonder whether these in fact are key risks. We recommend that you drop this list or better relate this list to the previous three lists. Further, the scope of each item is general; can the scopes be made more specific (e.g., geographic regions, developing vs. developed)? (UNITED STATES OF AMERICA)	The preceding lists are not focused on key risks but emergent risks. To address this concern, we added language in the introduction of the list of key risks which makes the connection to the other risk characteristics (like "emergent") clearer.
115	77697	19	4	29	4	44	Some of these risks have associated confidence assessments, while others do not. How should the reader interpret the absence of an assessment? One possibility is that confidence is low, or very low (but in that case, that should be said). Another is that there is insufficient evidence and agreement to warrent any kind of confidence assessment - in which case, it seems to me that the statement should not be in the ES. A third possibility might be that the evidence is so strong that the existence of the corresponding risk should be regarded as an incontrovertable fact. (Francis Zwiers, Pacific Climate Impacts Consortium)	Please see comment #67.
116	82958	19	4	29	4	44	Where key risks overlap here topically with emergent risks already presented, how should the reader understand the overlap? (Katharine Mach, IPCC WGII TSU)	We have a clear explanation in 19.1 of how to interpret such overlap.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
117	84353	19	4	29	4	44	Several of the key risks presented here overlap with emergent risks presented earlier in the executive summary. The first bullet intersects with the first bullet under indirect, trans-boundary emergent risks (page 3 lines 40-42). The third and fourth bullets intersect with the first bullet under interacting systems emergent risks (page 3 lines 8-11). The last bullet intersects with the fourth bullet under interacting systems emergent risks (page 3 lines 19-22). Key and emergent risks overlap as defined in the chapter, but it would be useful to better understand the distinction being made between the aspects of these risks that constitute emergent risks and those that constitute key risks. (Michael Mastrandrea, IPCC WGII TSU)	see response to comment 114.
118	80530	19	4	34	4	35	Confidence statement needed here. (Richard Betts, Met Office Hadley Centre)	bullet eliminated
119	82959	19	4	34	4	35	Is "land grabbing" included here? If so, to what degree would the risks be emergent? (Katharine Mach, IPCC WGII TSU)	bullet eliminated
120	84354	19	4	34	4	35	Standing alone, this bullet does not clearly communicate the topic introduced in the chapter text. I suggest a bit more detail here. (Michael Mastrandrea, IPCC WGII TSU)	This bullet point, as well as all other key risk bullet points, have been completely rewritten.
121	57797	19	4	36	0	0	high risk of loss - What is the time scale for the loss? Year, decade, century? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This loss risk begins now and runs throughout the century, as indicated in the text, so we do not think there is a need to add additional language here.
122	71397	19	4	36	4	38	Suggest replacing the term "economies-in-transition countries" with something more appropriate. This statement is based upon section 19.6.2 which states "... countries in transition due to changes in climate conditions as well as socio-economic structures ….". The statement is not referenced (it should be), but the countries that would be encompassed by the description is much broader than the EITs, a group of countries formally defined under the UNFCCC. (CANADA)	This bullet has been revised such that the comment is no longer relevant.
123	61462	19	4	37	4	37	"low-laying" and "low-lying" are descriptors used interchangeably for coastal zones. It would be good to settle on one. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	"Low-laying" has been replaced with "loy-lying."
124	80531	19	4	37	4	37	As well as rain-fed agriculture, should "glacier-fed" also be included here? (Richard Betts, Met Office Hadley Centre)	section rewritten
125	61463	19	4	39	4	41	It's not immediately clear what the links are between health, mortality and infrastructure failure, although these links become clearer in 19.6.2.1. Perhaps this bullet point could be re-worded to explain the linkages, e.g. through levels of heat stress (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This bullet has been rewritten and follows the reviewer's suggestion.
126	82960	19	4	39	4	41	Given the mention of systemic risk here, how should this example be interpreted as distinct from an emergent risk? (Katharine Mach, IPCC WGII TSU)	Systemic risks are emergent by their very nature; we think this is obvious.
127	62950	19	4	39	40	40	The risk of infrastructure failure is mentioned as a key risk, however it is hardly outlined in the course of the chapter. (Claudia Bach, United Nations University Institute for Environment and Human Security)	As is now more clearly discussed in 19.6.2.1, the list of key risks are a synthesis of input received from other chapters - input that identifies infrastructure failure as a component of one of the eight key risks.
128	70742	19	4	42	4	44	This needs a better rewording. Next to increased temperature also changed precipitation should be mentioned (e.g. important for water-related vector-borne diseases). It could be reworded into: …with the vulnerability conditions of individuals and society, for example, an aging population or differences in socioeconomic status... (Stefan Kienberger, University of Salzburg)	This bullet has been rewritten.
129	80532	19	4	42	4	44	I agree that there is a risk of increased disease burden, but also there are expectations of decreases in disease burden particularly due to decreasing vulnerability with increasingly wealthy populations. Eg: WHO (2003) - given prominance in AR4 - considered diarrhoeal disease to only be an issue in countries below a certain threshold GDP. (Richard Betts, Met Office Hadley Centre)	While this is true, the focus here on article 2 means the ES should highlight harm.
130	82961	19	4	46	4	47	This statement implies that alternative development pathways are further distinguished in the current assessment. Can this be drawn out further at the summary level? (Katharine Mach, IPCC WGII TSU)	Unfortunately, the literature does not support a detailed bullet on this point.
131	78894	19	4	46	4	49	I don't find this statement worthwile including in the executive summary, because it doesn't provide an actual finding; it's an active area of research, not a policy relevant conclusion. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	This bullet point has been rewritten.
132	84355	19	4	46	4	49	It would be useful to consider adding information from 19.6.2.2 on the role of development pathways in determining risks to this paragraph, as this would help explain the reason why the point in the sentence in bold is being made. In addition, SSPs are not discussed in 19.6.3.1. (Michael Mastrandrea, IPCC WGII TSU)	This point has been elaborated on and the discussion of SSPs has been deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
133	84356	19	4	51	5	26	It would be very useful to more clearly highlight what has and has not changed since AR4 for each RfC, and the level at which each red (or purple) transition occurs, even if unchanged from AR4. The introduction to 19.6.3 includes text that does this very nicely. (Michael Mastrandrea, IPCC WGII TSU)	We think the comparison with AR4 is important and have discussed this in the main text, but we do not believe it raises to the ES level.
134	57798	19	4	52	0	0	Unique human and natural systems tend to have very limited adaptive capacity - Caveat? Most, Many, Some? As written "all" is impled. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	More information on this point has been provided at the reviewer's suggestion.
135	77698	19	4	52	4	52	I stumbled upon the notion of a "unique system" - should there be some elaboration (only a few words) to help readers like me, who come to the chapter with an entirely different disciplinary background than the authors and the community that they draw from? (Francis Zwiers, Pacific Climate Impacts Consortium)	This point is clarified in the main text. There is not enough space to do so in the ES.
136	57799	19	4	52	4	54	High confidence - The caveat of time scale is needed here for SLR and ice sheet changes. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We are unsure what text is referred to in this comment.
137	62717	19	4	52	4	54	I could not find the description "unique human and natural systems tend to have very limited adaptive capacity, (...) if a global temperature rise of 2 degrees C over preindustrial levels were exceeded." in the main text. I think that the base year is not preindustrial level but is 1990 level. There seem to be many less careful descriptions for the base year of temperature rise. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	The RFC sections in the executive summary and the main text have been carefully revised such that baseline values are clearer and such that the executive summary is consistent with the main text.
138	80533	19	4	52	4	54	The term "outpace adaptation" implies that the issue is to do with rate of change, not merely magnitude, so a simplistic identification of a particular warming threshold (eg: 2 degrees C) is inadequate - this needs to be accompanied by a time horizon, or expressed as a rate of warming (eg: degrees C per century). This should also take account of uncertainties in regional climate change associated with any particular magnitude/rate of warming. Rate of change and their implications for species and ecosystems are discussed in Chapter 4, I suggest further cross-chapter discussion on this point. (Richard Betts, Met Office Hadley Centre)	The phrase 'outpace adaptation' has been removed and the unique and threatened species RFC bullet (in addition to all RFC bullets) has been completely rewritten. Additionally, Chapter 19 has worked extensively to coordinate with Chapter 4 on this section and the respective ES bullet point.
139	62718	19	4	52	5	5	The descriptions seem to be unscientific. The emission target of 2 degrees C rise relative to preindustrial level is an equilibrium target. In addition, the current temperature rise is still about 0.8 degrees C rise from preindustrial level. That means the temperature rise of 1.2 degrees C will be achieved over 300 years from now. The current science for global warming impacts has not been able to assess such small levels of temperature change. IPCC cannot and should not insist the assessment for adaptation capacity that without the limitations of the assessment. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	The main text of 19.6.3 goes into great detail on this point but it would be too much to add to the ES. Also, the past rise is irrelevant to this part of the ES text.
140	67888	19	4	52	5	5	Equilibrium temperature is usually used for temperature target. However, it will take over 300 years to reach equilibrium temperature. Whereas as exampled in Chapter 4, the rate of adaptation would be realistic and important principle. Also the uncertainties can be treated by the Decision cycle described in Chapter 2. Please assess the paragraph with taking into account these two view points. (JAPAN)	See reponse to comment 139. this section is NOT about targets; it is about risk.
141	67889	19	4	54	4	54	It is not discussed in the main underlying report that adapitive capacity will be very limited at (No description) "2 degree C over preindustrial levels" . Please check the base year. (JAPAN)	Please see comment 137.
142	80534	19	4	54	5	5	This statement refers to section 19.6.3.2 which in turn cross-references to Chapter 4, but many of the sources cited in section 19.6.3.2 on extinctions are not cited in Chapter 4 itself. Further cross-chapter work is required here to check for consistency and discuss the confidence statement on page 5 line 1. (Richard Betts, Met Office Hadley Centre)	Please see comment 138.
143	82962	19	5	3	5	3	Casual usage of "likely" should be avoided. (Katharine Mach, IPCC WGII TSU)	The chapter has been carefully edited to correct for this issue.
144	57800	19	5	6	0	0	Word missing - Add "assessment" after "risk". (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	section rewritten.
145	82963	19	5	6	5	7	It would be preferable to construct this finding such that it is fully accessible to a reader who doesn't have the 4th assessment report in hand. That is, is it possible to make the statement more stand-alone, with only secondary reference to the 4th assessment report? (Katharine Mach, IPCC WGII TSU)	The RFC bullet points have been edited such that the findings can now stand alone from AR4.
146	77699	19	5	6	5	8	Note however that some assessments of extremes have also been nuanced a bit differently subsequent to the AR4, both in Chapter 3 of the SREX (2012) report, and in the new WG1 AR5 extremes assessment (see the extremes table in the current version of the WGI SPM). In particular, assessments on tropical cyclones and droughts have been adjusted somewhat - and I think it would be necessary to make a note of important exceptions to the statement that is bit more specific than the hint that is given in the wording "some types of extremes". (Francis Zwiers, Pacific Climate Impacts Consortium)	This section (and the related main text) has been rewritten to be clearer about the final WGI assessment of extremes.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
147	80535	19	5	6	5	8	While this is true, there is also greater caution in attributing other types of extreme events in SREX and AR5 WG1 compared to AR4 - specifically drought and hurricanes have more nuanced discussion than in AR4, and more recent evidence (Sheffield et al, 2013, Nature) suggests that drought may not be increasing at a global scale as previously thought. This should be recognised here. (Richard Betts, Met Office Hadley Centre)	See response to comment 146.
148	57801	19	5	7	0	0	attribution of some types of extreme events - such as? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	see response to comment 146.
149	69871	19	5	15	5	18	Warming of less than 2C is not clear - presumably this means global mean change with respect to pre-industrial, but in this case could be interpreted as local temperature change. (John Caesar, Met Office Hadley Centre)	The chapter has been edited carefully to make baseline references more explicit - including in the discussion of the RFCs.
150	57642	19	5	19	5	24	Assess the literature, don't attack it. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Text rephrased to summarize our assessment in 19.6.3.5.
151	82964	19	5	19	5	24	For conclusions for this reason for concern, the chapter team is especially encouraged to consider the chapter 18 approach to the reason for concern, which is currently different, ensuring harmonized assessment across the chapters. (Katharine Mach, IPCC WGII TSU)	Text now reflects that we use a consistent definition of the RFC with Ch 18 that includes non-monetized impacts.
152	70743	19	5	20	0	0	…add next to 'biodiversity loss', also quality of life (or another concept which is human centered and independent from monetary measures) (Stefan Kienberger, University of Salzburg)	Text rewritten to summarize our assessment in section 19.6.3.5.
153	61464	19	5	20	5	20	Change "be quantified" to "been quantified" (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Text rephrased to summarize our assessment in 19.6.3.5.
154	82965	19	5	23	5	24	Does this statement imply that the preceding 2 sentences are the "overall assessment" that has not changed, or does the sentence refer to the general shading of the ember (which of course did not appear visually in the 4th assessment report)? Overall, it would be preferable to adopt a sentence formulation here where the reader clearly understands the "overall assessment" meant, with more secondary reference to the 4th assessment report. (Katharine Mach, IPCC WGII TSU)	Text rephrased to summarize our assessment in 19.6.3.5.
155	77700	19	5	25	5	25	Insert "assessment of" before "risk". Otherwise, this statement effectively ignores uncertainty in the determination of risk (we only know the risk with uncertainty, and thus we are not in a position to say with certainty that the risk is unchanged, but this is literally what the statement says). (Francis Zwiers, Pacific Climate Impacts Consortium)	section rewritten
156	57802	19	5	25	5	26	Delete "at least" and a time scale is needed for the melting of the ice sheet. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This bullet point has been rewritten.
157	59740	19	5	25	5	26	A proposed slight modification in the conclusion about the likelihood of large-scale singular events. As explained in a comment on the overall WGII report, I suggested a slight modification in the conclusion for Chapter 19, Section 19.6.3.6 about large-scale singular events (page 46, lines 37-38). Specifically, I proposed the replacement of the phrase “Greenland Ice Sheet” with one to the “East Greenland Ice Sheet”, as follows: Based on the weight of the above evidence, we judge that the risk from large-scale singular events, such as large-scale irreversible deglaciation, of the East Antarctica Ice Sheet, remains comparable to that assessed in AR4, as indicated by Smith et al. (2009) and Figure 19-5). So, I suggest the following, similar modification in the conclusion for the Chapter 19 Executive Summary: The risk from large-scale singular events, such as large-scale irreversible deglaciation, of the East Antarctica Ice Sheet, remains comparable to that assessed in AR4. (Thomas Dunning Newbury, U.S. Department of the Interior (retired))	See response to comment #5.
158	80536	19	5	25	5	26	What actually was the AR4 assessment on this point? Please state it here. (Richard Betts, Met Office Hadley Centre)	Section rewritten accordingly.
159	82966	19	5	25	5	26	Again, it would be preferable to make this finding more fully accessible to a reader who does not have the 4th assessment report in hand. Is it possible to make the statement more stand-alone with only secondary reference to the 4th assessment report? (Katharine Mach, IPCC WGII TSU)	Please see comment 149.
160	71398	19	5	28	5	32	This does not read like a key finding- basically this is the goal of adaptation. Suggest revising. (CANADA)	This bullet point was deleted.
161	82967	19	5	28	5	32	For the key, emergent, and emerging risks within the executive summary, is it possible to illustrate the assertion of this finding more specifically, risk by risk? (Katharine Mach, IPCC WGII TSU)	Entire section rewritten accordingly.
162	78895	19	5	34	5	46	The statements about avoided damages perhaps should be rephrased as 'reduced risks' to avoid a simplistic interpretation of certain damages definitely occurring above a certain temperature and definitely not below a certain temperature. More importantly, these statements (and their presentation in the Summary for Policymakers) would be much stronger and robust against any challenge if the authors were able to also synthesise the evidence that supports these findings from the sectoral and regional chapters of the WGII report. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	The underlying literature is mostly in terms of impacts avoided rather than risks reduced so we felt we were stuck with using the term to some extent. But in the rewritten ES, we segue quickly into using the term risk.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
163	68119	19	5	37	5	38	"Since mitigation reduces the rate as well as the magnitude of warming, it also delays the need to adapt to a particular level of climate change impacts, potentially by several decades." Globally speaking, this sentence is valid. Due to the inertia of the climate system, however, the temperature rise will continue even that the increased emission comes to a stop now. But it is very important to actively take adaptation measures to address the adverse impacts that have already occurred. In order to express the conclusions in a balanced manner, it is suggested to add the following after this sentence: "However, it is very necessary to actively take adaptation measures to address the adverse impacts that have occurred or are occurring". (CHINA)	Such a statement would be policy prescriptive.
164	84357	19	5	38	5	38	I would suggest deleting "impacts" here, as impacts may be different for a given level of climate change depending on the rate of change and socioeconomic conditions at the time the level is reached. (Michael Mastrandrea, IPCC WGII TSU)	Impacts' has been deleted at the reviewer's suggestion.
165	57643	19	5	40	5	41	Silly sentence. You really say: Most solutions are interior. Appropriate for a textbook in optimization, less so for the IPCC. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	The meaning of the comment eludes us.
166	84358	19	5	42	5	44	It is not completely clear what "comprehensive adaptation" means--avoidance of all impacts? Section 19.7.2.1 does not talk about this point, which it would be useful to clarify here and should be discussed in the section. (Michael Mastrandrea, IPCC WGII TSU)	This phrase has been deleted and the bullet point has been rewritten.
167	74180	19	5	43	5	43	Is comprehensive adaptation to climate risk prohibitively expensive at all scales and in all locations, or are there exceptions and/or "success stories"? (UNITED STATES OF AMERICA)	Please see comment 166.
168	80537	19	5	43	5	43	"prohibitively expensive" seems like a value judgement. Is this statement justified? (Richard Betts, Met Office Hadley Centre)	This phrase has been deleted and the bullet point has been rewritten.
169	82968	19	5	43	5	43	Would it be feasible to indicate here what is meant by comprehensive adaptation? Economically optimal adaptation, adaptation that illuminates adaptation deficits, etc.? (Katharine Mach, IPCC WGII TSU)	This phrase has been deleted and the bullet point has been rewritten.
170	84359	19	5	45	5	46	It is not completely clear where this 20-60% range comes from, as the numbers discussed in section 19.7.1 are somewhat different. (Michael Mastrandrea, IPCC WGII TSU)	This bullet point has been restructured and the content is now in alignment with 19.7.
171	77701	19	5	48	5	51	I would judge that there is currently very low confidence in feasibility, and thus that raises the question of whether it is wise to even remotely create expectations by promoting this to the level of the ES. (Francis Zwiers, Pacific Climate Impacts Consortium)	This bullet point has been deleted from the ES.
172	84360	19	5	49	5	51	I would recommend against using "low confidence" in this formulation. It seems that you mean either that there is limited evidence and low agreement about the feasibility and requirements of such early warning systems, or that there is high confidence that the feasibility and requirements of such systems are not known currently. Either of these formulations would make the point more clearly. (Michael Mastrandrea, IPCC WGII TSU)	This bullet point has been deleted from the ES.
173	82969	19	5	53	5	54	This statement somewhat overlaps with the 1st sentence of page 6. Would it be beneficial to acknowledge within the primary bold finding that risk of crossing tipping points can be reduced by limiting the level of climate change? (Katharine Mach, IPCC WGII TSU)	While we have rewritten this section, we still retain some overlap because we think the emphasis is important.
174	60105	19	6	0	0	0	Box 19-1 should be inserted after Figure 19-1 as it contains the UNFCCC article 2 which is mentioned in the introductory paragraph of this section. (AUSTRALIA)	This would be a very awkward way to structure the ES; the box is close by in any event.
175	70744	19	6	0	0	0	Fig. 19-1: The overlap between "key" and "emergent" needs to be specified in the text. Additionally the bubbles for "key" and "emergent" could be expanded to the hazard as wel as the vulnerability domain, as there are also key and emergent issues which later constitute the risk. Additionally it could be better emphasised how 'exposure' is associated with vulnerability. Is it part of vulnerability? Or an additional feature of vulnerable systems which can be exposed. Additionally exposure is also linked to the hazard, as the hazard will define the exposed area (e.g. through an increase flood hazard zone). (Stefan Kienberger, University of Salzburg)	Thank you for this comment - these issues are clarified in the new caption and figure.
176	74182	19	6	0	0	0	Could the discussion of the historical evolution of this chapter be placed toward the end of the document? While it is interesting, it is a bit distracting where it is currently placed in the document. If the authors feel that it is essential for the framing of the remainder of the document, perhaps this section could be shortened and tightened up, with a longer explanation included later in the document. (UNITED STATES OF AMERICA)	The section has been tightened somewhat - we think the positioning is necessary.
177	74181	19	6	1	6	3	This paragraph makes the case for the importance of "focal species" as a mechanism to determine priority tipping points; it may be worth referencing efforts underway to promote understanding in this area, such as the USFWS surrogate species program (UNITED STATES OF AMERICA)	We mention specific programs in the main text. 19.1 is not the place to do so.
178	61465	19	6	2	6	2	Insert "the" between "in" and "location" (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This sentence has been revised.
179	57803	19	6	3	0	0	and pollution - "or"? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We think "and" conveys the proper meaning.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
180	71399	19	6	6	6	26	It seems like the chapter is trying to cover too much, resulting in interesting and important points being buried within the text. Suggest removing some of the sections, to allow more useful discussion on those most relevant/interesting (e.g., emerging risks, key vulnerabilities and risks) and make sure the terms used are clearly defined, then used consistently throughout. (CANADA)	We have done our best to highlight key findings and make the use of terms completely consistent.
181	70745	19	6	22	0	0	As the terms "key" and "emergent" are key characteristics of this figure they should be shortly explained. Referring only to the glossary may be not sufficient to better understand the conceptual approach. (Stefan Kienberger, University of Salzburg)	The positioning of defintitions, figures, and boxes is always a difficult issue. Definitions should not be placed in figure captions. We believe that using BOX 19-2 is an effective compromise between putting too much in the main text and in any event, "emergent" is defined soon after this point and the location of the box and figure will be determine in the final set-up editing, where this point will be taken into account.
182	70746	19	6	23	24	0	Exposure not only results from "socio-economic development pathways and societal conditions" but also from changed hazard patterns (e.g. spatial extent of hazard zones) (Stefan Kienberger, University of Salzburg)	Text has been added to accommodate this point.
183	70747	19	7	7	0	0	Section 19.1.3.. While the new risk approach may help to better structure risks, exposure and vulnerabilities it is also a major shift in regard to the IPCC's terminology and understanding of vulnerability. Currently many assessments build on the approach of vulnerability as a function of sensitivity and adaptive capacity. Therefore it should be better justified (either here or in a later section) how the 'old' IPCC concept towards vulnerability can be translated to the new risk approach. (Stefan Kienberger, University of Salzburg)	This point has been addressed by expanding the definition of vulnerability.
184	77702	19	7	13	7	14	I think I did eventually figure out what the distinction was between "emergent" and "emerging" :). Regarding "emerging", the description on line 13 would be clearer if it avoided the word "emerged". Rather than saying "those which have only recently emerged in the scientific literature in sufficient detail to permit assessment", I would prefer something like "those for which our level of scientific understanding has only recently become sufficient to permit an assessment". It think it would be better to avoid making a subtle suggestion that the scientific community drives the determination of what is an emerging risk (by making the issue emerge in the scientific literature). (Francis Zwiers, Pacific Climate Impacts Consortium)	This point has been addressed by removing "emerging" as a separate category and using the sense of "recently become sufficient to permit assessment" in explaining the role of 19.5.
185	71400	19	7	14	7	14	Suggest being more concise/clear on "have the potential to become relevant to interpreting." (CANADA)	This point has been amplified with a cross-reference to criteria used to determine "relevant".
186	80545	19	7	15	7	16	I suggest re-wording as "since AR4, sufficient literature has emerged to allow initial assessment of *whether there is* a relationship between climate change and conflict". Chapter 12 is quite careful and nuanced here, and my reading of it is that it is not entirely obvious that there is a demonstrable link. (Richard Betts, Met Office Hadley Centre)	we have inserted the word "potential" to reflect uncertainty and contingency in this relationship.
187	82970	19	7	16	7	21	Are conflict and human security overemphasized in these framing statements? (Katharine Mach, IPCC WGII TSU)	See response to 186.
188	84361	19	7	29	7	30	It would be useful to mention exposure here as well as vulnerability, given the risk framing of the chapter. (Michael Mastrandrea, IPCC WGII TSU)	Sentence edited accordingly
189	84362	19	7	32	7	32	For clarity, I would suggest adding "those related to" before "vulnerability" in this line. (Michael Mastrandrea, IPCC WGII TSU)	Sentence has been rewritten.
190	80538	19	8	4	8	7	This is an accurate quote of the Copenhagen Accord - however, I would question the statement in the Accord claiming "the scientific view that the increase in global temperature should be below 2 degrees Celcius". In my opinion this is not a scientific view but a political one, as it relies on significant judgement calls regarding the level of risk that is acceptable, given the very large uncertainties in the impacts of any particular level of global warming. Indeed a similar view is expressed later in this chapter in FAQ19.3 (page 53 lines 30-31). While I agree that it is crucial to cite UNFCCC Article 2 and the Copenhagen Accord for context, I recommend accompanying this with commentary similar to that in FAQ19.3briefly explaining how the 2 degree target was arrived at, and citing cources for further discussion and context. (Richard Betts, Met Office Hadley Centre)	Statement has been removed and discussion of this point now occurs in FAQs
191	82971	19	8	13	0	0	Box 19-2. The chapter team should be sure to match the final glossary text for the text overlapping within this box. As an opening statement or as a footnote, it could be helpful to specify that these definitions go beyond those in the glossary, in indicating the starting point for this chapter's assessment. (Katharine Mach, IPCC WGII TSU)	A parenthetical note to this effect has been added in 19.1.1
192	57619	19	8	15	8	16	I suggest that the concept of vulnerability should also be consistent with SREX. (GE GAO, National Climate Center,China)	The definition is consistent with SREX but has been expanded as noted in response to 191.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
193	63678	19	8	15	8	16	Please add: "Vulnerability describes the socio-economic characteristics of a system. It includes its sensitivity or susceptibility, adaptive capacity and coping capacity in this report. In AR4, the term vulnerability has been used differently than here." (GERMANY)	The first point has now been accomodated. We do not think Chapter 19 is the place to emphasize definitional differences with AR4 - that should occur in the Glossary because it affects many chapters.
194	63679	19	8	15	8	16	Please delete: "and exposure". Do not mix the definitions of exposure and vulnerability. (GERMANY)	Exposure is now positioned in Box 19-2 ahead of vulnerability so we think the relationship is now clear, and it is preferable not to repeat the same point about " a broad set of factors" twice.
195	66299	19	8	15	8	16	This definition is an extension of that in the glossary. Why is "exposure" included here? It muddies any distinction one might wish to make between vulnerability and the next term defined, exposure. (Timothy Carter, Finnish Environment Institute)	See response to comment 194.
196	80132	19	8	15	8	19	Difference between vulnerability and exposure is not clear as the term exposure is used when defining vulnerability (Peter Rauch, University of Natural Resources and Life Sciences, Vienna)	See response to comment 194.
197	63680	19	8	18	8	19	Please change the ; into , (GERMANY)	Done
198	66300	19	8	18	8	19	Same comment as for glossary and SPM: Does exposure necessarily have negative connotations? One could similarly be exposed (or not) to beneficial conditions. Furthermore, shouldn't the term "exposure" be qualified (i.e. in relation to those conditions)? Hence, exposure to climate-related risks or opportunities, in contrast to exposure to some other circumstance (e.g. volcanic eruption, job loss or tax break). (Timothy Carter, Finnish Environment Institute)	For Chapter 19 purposes, where the issue at hand is Article 2, this definition is adequate.
199	82972	19	8	18	8	19	As a note, the current glossary version of this definition differs slightly. (Katharine Mach, IPCC WGII TSU)	We worked to ensure consistency.
200	70748	19	8	19	0	0	It is not clear, how exposure relates to vulnerability. Is exposure part of vulnerability or an additional component of vulnerable population which can be exposed? (Stefan Kienberger, University of Salzburg)	These are separate concepts according to our definitions. The rearragnement in response to comment 194 makes this clearer.
201	77703	19	8	19	8	19	Would it be better to replace "could" with "would" (i.e., will be affected if a hazard materializes, instead of could hypothetically be affected if a hazard materializes)? (Francis Zwiers, Pacific Climate Impacts Consortium)	We think the sentence is clear and correct as it stands.
202	66301	19	8	21	8	21	Are impacts not considered here only in relation to climate? If not, this opens up the definition to any consequences of any event or disaster on any natural or human system (i.e. all responses to causal processes that are known to humankind!) Perhaps the definition needs narrowing a little. (Timothy Carter, Finnish Environment Institute)	Definition rewritten to emphasize climate-related imapcts.
203	77704	19	8	21	8	21	Why is there a chapter specific definition? (Francis Zwiers, Pacific Climate Impacts Consortium)	Revised definition no longer specifies "chapter".
204	63681	19	8	21	8	27	Please be more specific and clear, thus differentiate and create separate definitions for impacts in general, physical impacts on geophysical or natural systems and socio-ecological impacts on human systems. Please be consistent with these term as used in chapter 18 and others. 1. Def on Impacts: Effects on natural and human systems. Impacts are also referred to as consequences and outcomes. 2. Def on Physical impacts: In this chapter, physical impacts refer to effects of climate change on natural systems, such as floods, droughts, and sea level rise. 3. Def. on Socio-ecological impacts: In this chapter, the term is used to refer to the effects on human systems of climate change and its physical impacts as well as of other physical events, of disasters and effects of non-climatic drivers. They are a function of exposure and vulnerability, and generally refer to adverse effects on lives, livelihoods, health status, ecosystems, economic, social and cultural assets, services (including environmental), and infrastructure due to the interactions of climate change effects or other impacts occurring within a specific time period and the vulnerability of a system exposed. (GERMANY)	This defintion has been rewritten to be clearer and to be identical to the Glossary definition for the entire report. We believe a unified definition which makes the connection clear is preferable to the three-part definition recommended by the reviewer.
205	70749	19	8	21	8	27	The definition of 'impacts' is misleading: It states that impacts are a function of exposure and vulnerability (only?), whereas later it states that also it is defined by the interaction with hazardous events (which makes sense). Actually an impact would be the manifestation of risk as the final outcome. Additionally, a link to the health domain should be made, where also impacts can be obsereved to an increased burden of disease (e.g. higher morbidity or mortality due to changed malaria occurence (based on climatic factors) as well as changed socio-economic conditions (e.g. in conflict prone areas). (Stefan Kienberger, University of Salzburg)	This defintion has been rewritten in a manner which eliminates the first issue. The point about impacts (or consequences) being the manifestation of risk is made in the definition of risk; adding it here would make a long defintion overly long. We are unclear as to what precisely the reviewer would like us to do with regard to the health issue.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
206	76774	19	8	21	8	27	The last sentence would be cleared if rephrased. Are floods an effect of climate change, a geophysical system or a physical impact? According to the beginning of the defintion, flood would be a hazardous physical event which might impact natrual or human system. (Nicolas Desramaut, BRGM)	Definition rewritten to clarify this point.
207	66302	19	8	22	8	22	Why only hazardous events? Impacts of events can also be beneficial. (Timothy Carter, Finnish Environment Institute)	Definition rewritten in more neutral language.
208	82973	19	8	23	8	23	Should the possibility of positive impacts be more explicitly recognized, although not the focus of this chapter? Also, would it be most accurate to specify that impacts are a function of exposure, vulnerability, and physical hazards? (Katharine Mach, IPCC WGII TSU)	See response to comment 207
209	71401	19	8	23	8	24	Is the focus on impacts being on adverse effects consistent with the definition used in the full report? Suggest reviewing. (CANADA)	See response to 207 - definition now alinged with Glossary
210	63682	19	8	29	8	32	Please be clear: Hazards are normally not used for the effects of trends but only on hazard as stated in the first sentence of the definition. Thus use the term climate change signals and its physical impacts instead of hazard also in figure 19-1. Only ff heat waves which have direct impact on humans are also considered physical impacts, you also might use only "physical impacts" instead of hazard. (GERMANY)	Both the figure and the definitions have been revised so "hazard" includes trends and events throughout. By our definition, physcial impacts are only a subset of hazards. We think the current definitions are now clear and consistent on this point.
211	63683	19	8	29	8	32	Please change the definition thus hazard is always including effects of trends, not only events. Please change: " In this chapter, hazard usually refers to climate change and its physical impacts." (GERMANY)	See response to comment 210.
212	70750	19	8	29	8	32	Could the hazard extended beyond the "natural or human-induced physical event" also towards disease affected areas? E.g. the presence of malaria in a certain area? Additionally the 'cause' could be expanded also towards "an increase of the burden of disease" (Stefan Kienberger, University of Salzburg)	We acknowledge that this generalization would be pertinent if we discussed vector borne diseases. But given the specific phenomena discussed here, the extended definition is unnecessary.
213	77705	19	8	31	8	31	Why is there a chapter specific definition? (Francis Zwiers, Pacific Climate Impacts Consortium)	Other chapters may discuss a broader range of hazards which create vulnerability to climate changes. While we mention this possibility here, it does not provide a major focus so we prefer to emphasize the narrower definition.
214	66303	19	8	34	8	34	Is "not-climate-related" an adjective? More seriously, the term stressor is used extensively in ecology, agronomy and other physical sciences in relation to both climatic and non-climatic factors that affect organisms/systems. I don't think this definition can stand as it is in the context of its wider useage. It needs to be qualified as "non-climate stressor" or something similar. (Timothy Carter, Finnish Environment Institute)	The definition has been changed to make it general to all stressors. In fact, the usage in the chapter already specifies non-climate stressors where appropriate.
215	82974	19	8	34	8	35	Within the glossary, a relevant term is " non-climatic driver." If the chapter team would prefer to have the term "stressors" or "non-climatic stressors" (the latter term used on page 11, line 27, page 14, line 35, and page 16, line 23) within the report, please let the glossary editors know. (Katharine Mach, IPCC WGII TSU)	see response to comment 214.
216	74183	19	8	37	0	0	"Risk" is defined as the potential where something of human value is at stake. Does this include conservation of nature for nature's sake? In other words, how do the authors consider and define "human value" of natural ecosystems, for example, beyond ecosystem services such as water purification or tourism? Is there a desire to protect from risk vulnerable ecosystems for reasons other than those valued from a less anthropogenic reason? (UNITED STATES OF AMERICA)	We consider non-economic features like existence value of species and ecosystems to be encompassed by "something of human value". Since this is a risk framing, it must inevitably refer back to how humans value features of the earth system.
217	63684	19	8	37	8	39	Does risk only refer to events not to trends? Then risk is not the appropriate term in this context. Otherwise change the definition to include all kinds of climate change effects. Are environmental losses without effects on humans not considered here? What about the effects of environmental losses on humans not yet understand? Please change into: "The potential for impacts where something of potential human value (including humans themselves) is at stake and where the outcome is uncertain. This report assesses the risks of climate-related impacts". Please delete the second sentence because climate related impacts here cannot be assessed by probability of occurrence multiplied with consequences, both cannot be projected, also climatic effects are not only related to events but also to trends, which do not need to be hazardous. (GERMANY)	The point about trends has been dealt with by adjustment of various definitions throughout (see response to comment 210). We disagree on "potentila for...something of potential human value". Not only is the double use of potential awkward, but In assessing a risk, the question of possible future value is already encompassed by the term "human value" because potential itself has value.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
218	63685	19	8	37	8	39	Please be clear: Is consequences here and below used as synonym for impacts in general or only for socio-ecological impacts? See also use of consequences in the impact definition (Page 8, Line 21 ff). In Figure 19-1 it seems that risk relates only to socio-ecological impacts. (GERMANY)	The definition of impacts makes it quite clear that the word is synonymous with consequences and outcomes, unconditionally. Socioecological implies impacts involving both social and ecological components jointly. The figure allows each to result from risk, both severally and jointly.
219	63686	19	8	37	8	39	Please differentiate clear between impact and risk. Risk is an assessed impact, thus (potential) impact (also in figure 19-1) should be the central term. Also change into: "This report assesses the risk of climate-related impacts". (GERMANY)	This is already clear in the definition of risk
220	70751	19	8	37	8	43	The current definition of risk is misleading and in contradiction to what is shown in Fig. 19-1. Fig. 19.-1 defines risk as a function/combination of physical hazard events, vulnerability and exposure. Now the term consequences (not specifcially defined) is introduced. The impacts definition also mentions that, impacts can be referred to as consequences, but this is perceived as an additional synonym. To be clear, it would be better to define risk as the: Probability of (hazardous) events X vulnerability (would be in line with Fig 19-1). Additionally, it should be clarified how exposure relates to risk/vulnerability. The impact/consequences would be an outcome/manifestation of the risk itself. Otherwise, if impacts are defined as a a function of exposure and outcome, than they would need to be renamed as 'potential impacts'/'potential ouctomes. However, in general the definitions are not yet that clear and need to be better harmonised. (Stefan Kienberger, University of Salzburg)	Consequences is noted to be synonymous with impacts in the text and Box 19-2, where this relation is highlighted with italics. The relations among Impact, Vulenrability, and Exposure have been clarified in the rewritten and expanded definitions of Impact and Vulnerbility.
221	80546	19	8	37	8	43	I suggest that opportunities ought to be considered here too (eg: Figure 19-9 shows benefits as well as negative impacts). The UK Climate Change Risk Assessment included opportunities as well as negative risks, and indeed included opportunities under a wider definition of "risk" (since opportunity can also be defined in terms of probability times consequence). It's important not to give the impression that this chapter thinks that "all change is bad" as that makes it look as if benefits are being overlooked. It is clear that there are positive as well as negative impacts, and while the evidence does point towards the negatives outweighing the positives, there is no reason to not discuss the benefits. (Richard Betts, Met Office Hadley Centre)	Given the relation of chapter 19 to Article 2, the emphasis on harm is appropriate.
222	63687	19	8	41	8	41	This equation does not make sense in this context: what events are meant (climate change events or physical impacts)? What consequences are meant (physical or socio-ecological impacts)? How can you measure the probability of a future event under climate change considering the uncertainty (of events!!)? Are trends also events? What about positive impacts of climate change - are they also risks? (GERMANY)	See responses to comments 210 and 220.
223	63688	19	8	45	8	45	Key impacts seem to be used here synonymously to key risks. Please clarify the difference! Key impacts is not explained and used any further? (GERMANY)	Definitions here rewritten to make these distinctions clear.
224	70752	19	8	45	9	3	It was already mentioned in response to Fig 19-1; but as here also "key vulnerabilities" are being described, this could also be represented in the Figure by expanding the 'key' bubble. Additionally, this leads to the problem of the definition of impacts and its relation to risk, which is not consistent yet (and associated components). (Stefan Kienberger, University of Salzburg)	We now believe the definitions are consistent on this point. The figure has also been redrawn to clarify this point.
225	63689	19	8	50	8	52	Are key risks always adverse consequences/impacts or also positive ones? Please change the text to make clear that key risk can arise from hazardous climate changes and also from trends in climate change, i.e. effects of mean temperature increase on glaciers? (GERMANY)	see response to comment 221
226	63690	19	8	50	8	52	Please be clear about the relation of climate change effects and physical impacts (which are part of climate change effects), therefore change into: "… due to the interaction of climate change effects such as hazardous physical impacts with ...". Also change into "... "key" due to climate change effects alone, absent ..." (GERMANY)	We believe these distinctions are already clear in the previous definitions and the adding the word "effects" would be incorrect since effects are part of the definition of impacts.
227	66304	19	8	52	8	52	This sentence is incomplete. (Timothy Carter, Finnish Environment Institute)	We disagree.
228	63691	19	9	1	9	3	Please be clear about the relation of climate change effects and physical impacts (which are part of climate change effects). Please differentiate clearly between physical impacts and socio-ecological impacts. (GERMANY)	The rewritten definition of impacts makes this distinction clearer.
229	66305	19	9	2	9	2	The important term here is "severe", which presumably is subjectively defined, according to the decision-making context (cf. lines 11-12 below). I suggest merging the AR4 extract into a new integrated definition that recognises the role of judgement in determining what is "key". (Timothy Carter, Finnish Environment Institute)	While this is an important point, we don't believe the Box is the right place to handle it. Instead, the discussion of criteria for determining "key" in section 19.2 is the preferred location for the connection to expert judgment.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
230	66306	19	9	3	9	3	Should this read "climate-related risk", because if not it would include any hazard regardless of cause and in many cases unrelated to climate change. (Timothy Carter, Finnish Environment Institute)	We have adopted this suggestion.
231	61466	19	9	14	9	16	The definition of "emergent risks" could be usefully expanded. One could argue that all risks arise "from the interaction of phenomena in a complex system", but the authors are clearly trying to get at something more tightly constrained, relating to the new risks that may emerge as a consequence of certain mitigation and adaptation actions. The first clause of this definition could therefore be re-worked to make this clearer. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Not all emergent risks are "new". In any event, the definition has been rewritten and the relatex text clarified on this point.
232	70753	19	9	14	9	16	Here also the definition of risk is not that much consistent with the above mentioned definition. Specifically the geographic shifts in population would next to an increased vulnerability lead specifcially also lead to a changed 'exposure'. Again here also the link between exposure and vulnerability is not clear and should be added or clarified (Stefan Kienberger, University of Salzburg)	We have edited this pont for clarity and added exposure to the example.
233	71402	19	9	14	9	16	Why was the term "emergent risk" chosen? Confusing to use in chapter with "emerging risk", and emergent doesn't seem to capture the concepts that well- as the examples seem to be more about cumulative, cascading and indirect impacts. (CANADA)	The term "emerging" eliminated from use in this chapter.
234	77706	19	9	14	9	16	Would it be worth noting that emergent risks may not be continually present, whereas an emerging risk could represent a permanent alteration in risk (in the absence of adaptation or mitigation of the factors that create the risk)? (Francis Zwiers, Pacific Climate Impacts Consortium)	See reponse to comment 233
235	66307	19	9	14	9	22	These two terms: "emergent" and "emerging" are very close in form but have quite different meanings here. I am worried that using them side by side could be potentially confusing for readers, let alone interpreters and translators into other languages! Emergent risk presumably is a phenomenon that aggregates a set of component causal factors that on their own might not cause concern, but together represent a tangible risk. Emerging risks seem to be defined here as risks that have only recently become recognised. Some of these may be emergent, in the sense given above, but some may not, which implies that there are also risks that are not associated with complex systems. But how are we supposed to distinguish these two types of risk? Indeed, some would argue that ALL risks are complex and compound phenomena. The examples in Table 19-3 do not provide too much illumination on the difference either. I would favour dropping one of these terms (emerging) and sticking to the formulation in the title and plenary agreed outline "Emergent risks", and I agree that the only emergent risks considered in the chapter (as stated on p13, L23-24) should be those that have the potential to be judged "key risks" (a term defined later). Overall, then, it appears that key risks are already identified as important (reasons for concern), while emergent risks are still only candidates as key risks. Emergent risks could then have three categories: "Compound emergent risks" are risks that emerge from a compound phenomena including interactions and feedbacks; "Indirect emergent risks" are risks that emerge from indirect impacts or causes that may be remote from the location of the risk; "Newly emergent risks" are risks that emerged only recently, either being newly identified to science, previously judged insignificant but now significant, or previously overlooked and now judged significant. (Timothy Carter, Finnish Environment Institute)	See response to comment 233.
236	77707	19	9	18	9	19	As noted in a previous comment, I think the description of an emerging risk would be clearer if it avoided the word "emerged". Rather than saying "those which have only recently emerged in the scientific literature in sufficient detail to permit assessment", I would prefer something like "those for which our level of scientific understanding has only recently become sufficient to permit an assessment". It think it would be better to avoid making a subtle suggestion that the scientific community drives the determination of what is an emerging risk (by making the issue emerge in the scientific literature). (Francis Zwiers, Pacific Climate Impacts Consortium)	The definitions have been rewritten - see also response to comment 233.
237	70754	19	9	24	9	25	A short refelection on the differences between emergent and emerging should be provided here, as the definitions alone may be not clear enough. This would better help the understanding of the concept behind. (Stefan Kienberger, University of Salzburg)	See response to comment 233.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
238	70755	19	9	47	0	0	Section 19.2. should (as mentioned above) better justify the difference to the 'traditional' IPCC definition of vulnerability (as a function of sensitivity and adaptice capacity). The shift in terminology should be clearly justified as well as the 'old/traditional' concept should be translated (or discussed if it can be translated). The issue is, tha already many assessment approaches build on the 'old' IPCC concepts. Therfore better justification and a better explanation of the interlinkages between the new and old concept should be emphasised. (Stefan Kienberger, University of Salzburg)	Differentiating hazards and climatic stressors on the one hand and the vulnerability of a society or ecosystem on the other is an important advancement of the IPCC focus. This clear differentiation of the physical processes on the one hand and the inner conditions of societies or ecosystems exposed has also been done in the IPCC SREX report. Chapter 1 and 2 in particular provide various arguments on why it is essential and important to not include the hazard in the vulnerability definition as before. We refer to the respective literature and also have various arguments on this point when we deal with criteria for key vulnerability and key risks. Consequently, we have been quite precise on why these differences matter. Practical assessments will need to a apply a slightly different focus, but this is also normal and corresponds to the improvement of knowledge since AR4.
239	80547	19	9	47	14	16	Section 19.2 should include opportunities as well as risks (Richard Betts, Met Office Hadley Centre)	The framework for the assessment of key vulnerabilities and key risks focuses on the potential negative consequences, since it is linked to Article 2 of the UNFCCC protocoll.
240	80548	19	9	51	10	4	Also mention the UK Climate Change Risk Assessment (details on the Department for Environment, Food and Rural Affairs - Defra - website). This had a definition of risk in the context of climate change which also included opportunity. (Richard Betts, Met Office Hadley Centre)	This source has been checked and integrated.
241	82975	19	10	9	10	9	As a very minor point, should it be "risks of climate change"? (Katharine Mach, IPCC WGII TSU)	Risk of climate change would perhaps give the impression that risk are primarily determined by the climate signal - this is not overall the case.
242	70756	19	10	12	10	20	Definitions provided here need to be cross-checked with the definitions provided in box 19-2. e.g. again the link between vulnerability and exposure. (Stefan Kienberger, University of Salzburg)	That has been done.
243	63692	19	10	22	10	23	Key impacts are missed in figure 19-1 and in the rest of the chapter. Please make clear that they are merged with key risks (by risk assessment!). (GERMANY)	A definition of key impacts has been added to Box 19-2.
244	70757	19	10	22	10	23	It should be better justified why the new conceptualization provides a more coherent and precide systematization compared to the concept used in AR4 (Stefan Kienberger, University of Salzburg)	A justification now is given with references to newer literature .e.g. de Sherbinin.
245	63693	19	10	51	10	52	To me, the information in this sentence ("Generally, vulnerability merits…") is self-evident and thus does not have to be mentioned here. (GERMANY)	We think that this point is still important, since even though different people judge the important of different assets differently, larger reports such as UNISDR underscore that particularly attention needs to be given if societies, communities or ecosystems are at risk.
246	76775	19	10	52	10	54	To be rephrased (or remove "both") (Nicolas Desramaut, BRGM)	both' has been deleted.
247	61467	19	11	1	11	2	This sentence needs re-wording - either the "focus" or "priority" could be removed (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	In our reading - 'focus with a priority' is appropriate wording.
248	63075	19	11	5	0	0	Sections 19.2.2.1 and 19.2.2.2: I had the impression that the criteria outlined for key vulnerabilities were clear and understandable while the criteria for key risks were not that convincing. The points 1)-4) outlined in key risks seem to overlap quite a bit, and redundancies are present, such as the aspect that hazards and/or vulnerabilities need to be high to identify a key risk. As a suggestion, one could first state the general criterion that hazards and/or vulnerabilities need to be high, and then go down and explain which drivers of hazards and vulnerabilities are important. (Christian Huggel, University of Zurich)	Criteria for key vulnerability and key risks have been modified.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
249	63694	19	11	7	11	19	Please add: Vulnerability as used in AR4 includes potential impacts as function of exposure and sensitivity as well as adaptive capacity. The socio-economic characteristics of a system was include by considering its sensitivity and adaptive capacity. Risk was not used as a term but included in the potential impact concept. (GERMANY)	A more detailed discussion of the differences between the AR4 and AR5 definition and concept would require much more text, hence we think that the current differentiation is sufficient. Definitely, socio-economic characteristics were included in the former AR4 based vulnerability concept, however, the differentiation between vulnerability and risk is our point we want to make. It should be seen as a further development of a concept.
250	63695	19	11	7	11	19	Please make clear that vulnerability as used in AR4 is different than vulnerability used here! Thus the criteria cannot be transferred one to one (i.e. connection between exposure and vulnerability or relation between vulnerability and adaptive capacity). Please be aware that climate change impacts are also due to trends not only to events! (GERMANY)	The following sentences in this paragraph state that we are revising and further developing these criteria - also based on a modified concept (see Figure 19-1)
251	71403	19	11	7	12	24	Are these really criteria? How are they used? Criteria implies that each one must be met in some way, but there's no mechanism for this type of evaluation presented here. For example, is something only a key risk if it meets all of the criteria, some of the criteria... are they weighted or evaluated differently? (CANADA)	The criteria were, for example, applied in the assessment of key risk by other chapters and their provision of input for CC-KR.
252	79081	19	11	8	12	24	You mention eight criteria, but have only seven points numbered. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	This has been corrected.
253	62955	19	11	9	11	9	For additional literature on identifying key vulnerabilities see: Cutter,S., and Corendea,C. 2013. From Social Vulnerability to Resilience: Measuring Progress Toward Disaster Risk Reduction. SOURCE No.17. UNU-EHS, Bonn, Germany (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	The Source publication is good, but rather relevant for specific aspects of vulnerability, such as the vulneraiblity of critical infrastructure. The source contains less information about overall criteria for key vulnerabilities.
254	58956	19	11	18	0	0	Section 19.2.2.1: Eight criteria are mentioned (in line 18, page 11) to identify key vulnerabilities, but only seven criteria are effectively developped then in the section. (EVELYNE FOERSTER, BRGM)	This has been corrected.
255	76776	19	11	18	11	18	seven criteria instead of eight (Nicolas Desramaut, BRGM)	This has been corrected.
256	77708	19	11	18	11	18	The text refers to eight criteria, but only seven are listed. (Francis Zwiers, Pacific Climate Impacts Consortium)	This has been corrected.
257	77709	19	11	18	11	19	A few words on how the criteria are used would be helpful. For example, is it necessary that only one of the criteria be satisfied to judge whether a vulnerability is key, or should multiple criteria be satisfied? If so, are all weighted equally? A few words on the extent to which the criteria evaluate things that are inter-related would also be helpful. (Francis Zwiers, Pacific Climate Impacts Consortium)	This issue has now been inserted and discussed before point 19.2.2.2. - we inserted a sentence on how the criteria were applied.
258	57620	19	11	18	12	14	In text, the following eight criteria are used to judge whether vulnerability are key. Only seven criteria are list here. (GE GAO, National Climate Center,China)	This has been corrected.
259	63696	19	11	20	12	24	Overall, based on the previous remarks, I do not find this categorization helpful, as the many overlaps make it much to complex, and I do not see the use in operationalization this idea of key vulnerabilities. You should try to bring it down to less criteria, maybe based on the "classic" approach of exposure, sensitivity, adaptive capacity, maybe adding the idea of tipping points, which are not covered in these traditional approaches. I find the following criteria on key risks much easier to understand and straightforward. (GERMANY)	The criteria have been modified. Moreover, we differentiate between factors of vulnerability or components, such as susceptibility or sensitivity, lack of coping and lack of adaptive capacities AND the criteria for assessing whether a vulnerability is key. The criteria hence are a second layer that underscore that if different vulnerabilities are defined, one has also to judge whether they are key. How to do it? E.g. the importance of the system that is vulnerable or its coping and adaptive capacities.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
260	77710	19	11	20	12	24	The description of these criteria seems to be a slightly uneven. Some criteria describe the metric that will be used separately from the criterion that will be applied to that metric (e.g., criterion 2), while others (such as 4), seem to combine the metric and the criterion in a single statement. I like the former approach a bit better, but I think my main comment is that it would be a bit tidier to have a consistent presentation for all 7. Thus for 4) and 5), I would delete "limited" and state subsequently that societies with limited abilities would be judged to have key vulnerabilities. (Francis Zwiers, Pacific Climate Impacts Consortium)	The criteria have been revised. We tried to improve the differentiation and also now underscore that the criteria for key vulnerabilities are somehow also a sub-set of the criteria for key risks, since risks are a product of the interaction of a hazard and the vulnerability of societies or ecosystems exposed. The limited adaptive capacities for example are a coherent element for assessing whether a vulnerability is key, since societies or systems that can build adaptive capacities are less vulnerable in our view and the view of other chapters in this report (e.g. see limits of adaptation chapter).
261	70758	19	11	22	11	23	This statetment might by right, but the critical challenge is to know what will be affacted (the hazard). E.g. land behind a dyke might not be affected by floods, therefore less exposed; however they are still vulnerable (because of their conditions) as well can be exposed when an 'unprecedented' event may occur. Probably such critcial issues could be emphasised and still give importance to vulnerability independet of exposure. (Stefan Kienberger, University of Salzburg)	The criteria are still valid - exceptions are exceptions.
262	61468	19	11	23	11	24	Could the authors offer a brief example of how the "exposure to climatic hazards and non-climatic stressors can be assessed based on spatial and temporal dimensions"? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	There are various papers on how to assess exposure to hazards linked to climate change, e.g. Flood scenarios and respective assessments of elements exposed or scenarios of the number of people exposed to storm surges or sea-level rise. The literature is cited. The assessment of exposure to non-climatic hazards might in some cases be more complex, but for example for global vulnerability assessments respective methods were examined by de Sherbinin 2013 and also Welle et al. 2012 (these sources are also quoted in the report)
263	63697	19	11	25	11	35	The second criterion also contains exposure (e.g., "communities in low-lying areas"), which is already covered in the first criterion. (GERMANY)	Communities in low-lying areas is an example and the main point here is that they have limited resources for example to adapt to hazards linked to climate change, such as sea-level rise. We could also have chosen as an example of people in drought prone regions - it would contain a certain attribution of being exposed, but the main point as indicated are characteristics of those that are exposed in these areas - hence it is not about the exposure, but about the different capacities of people similarly exposed or living in the same landscape (low-lying area).
264	63698	19	11	25	11	35	This does not explain how to identify vulnerability as key before the connected risk has been assessed. It only refers to "particular susceptible social-ecological systems", without saying more than general things about how this is defined. This information is not more information than given in AR4. (GERMANY)	The criteria regarding the probability of harmful consequences has been moved towards the risk criteria in order to ensure that the differentiation between vulnerability and risk is more precise. Hence, this section was revised. Probability refers primarily to the occurance probability of a natural event or hazard, hence it is more appropriate to move this criteria to the risk criteria. This also improves the balance between the number of criteria defined for key vulnerability and key risk as commented before.
265	61469	19	11	28	11	28	"Land grabbing" is an important, although somewhat loaded, term. Could the authors refine what they mean by it? Elsewhere the text talks of land dispossession - how do these relate? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have changed the term and revised the section.
266	61470	19	11	36	11	47	Criteria number 3, in touching upon the existential threat to some systems, links with criteria number 6 and the question of irreversibility. This could be made more apparent in the text. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This connection is now made explicitly.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
267	79974	19	11	40	11	40	Please consider reflecting this finding also in the TS and possibly in SPM. (NORWAY)	These findings are considered, particularly, since these criteria were applied as a basis to assess and identify key vulnerabilities and key risks in the Table 19-4 which is part of the SPM.
268	79775	19	11	42	0	0	The issue of soil fertility is brought up here but never revisited in the rest of the chapter (Jessica Gutknecht, Helmholtz Centre for Environmental Research-UFZ)	It is meant as an example and this is a cross-cutting chapter.
269	62956	19	11	42	11	43	Neither the literature on climate change nor on loss and damage fully reflects the circumstances under which households (HHs) manage climatic stressors, resulting societal impacts, and the consequences of not being able to adjust sufficiently to negative impacts. Policymakers need better information, empirical data and analysis of both the challenges and the potential solutions. In response to this need, the Loss and Damage in Vulnerable Countries Initiative carried out research to find out how the impact of climate change on society leads to loss and damage among vulnerable HHs. For reference to this case studies, see: Warner, Koko, van der Geest, Kees, Kreft, Sönke, Huq, Saleemul, Harmeling, Sven, Koen Kusters and Alex de Sherbinin (2012). Evidence from the frontlines of climate change: Loss and damage to communities despite coping and adaptation. Loss and Damage in Vulnerable Countries Initiative. Policy Report. Report No. 9. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS); for more references see also SREX 2012 Report and Abedin, M A, Habiba, U., and R. Shaw (2012). Chapter 10 Health: Impacts of Salinity, Arsenic and Drought in South-western Bangladesh. In . Environment Disaster Linkages (Community, Environment and Disaster Risk Management, Volume 9), Shaw, R. and Tran, P., eds. Emerald Group Publishing Limited, pp.165–193. (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	The literature is important, however, it does not fit to the criteria discussed here, which is mainly the fact that certain losses can not be compensated. The literature has been cited under lack of coping capacities, since the studies undertaken by Warner et al. 2012 can inform this point.
270	79975	19	11	42	11	43	Please consider reflecting this finding also in the TS and possibly in SPM. (NORWAY)	This point is now reflected in the SPM (at this juncture at least).
271	63699	19	11	48	11	54	It is not helpful for the operationalisation of vulnerability to differentiate between coping and adaptive capacity. It is not clear in which way coping capacity relates to susceptibility or sensitivity. (GERMANY)	This differentiation is already discussed in the IPCC SREX report that also provides a key input for the modified framework on vulnerability, risk and hazards. In the report even an entire table compares the different characteristics of coping and adaptation based on newer literature (see table 1-1 in the IPCC SREX report) (IPCC 2012). We follow this differentiation of coping and adaptation since it is relevant for management strategies to reduce risk and for adaptation policies.
272	63700	19	12	1	12	10	I find it difficult to see the difference (particularly when it comes to operationalizing these ideas) between the 4th, the 5th and the 2nd criterion. Here you talk about the limited ability to build adaptive capacities, while in the 2nd criterion you talk about "susceptible societies" and "communities...with limited resources to adapt". (GERMANY)	In quantitative and qualitative assessments, susceptibility or sensitivity and response capacities of systems or people that are vulnerable are differentiated. For example CC-KR and Table 19-4 underscore that multidimensional poverty is often a characteristic that makes people more susceptible. However, it would be a false interpretation of the literature if one only classifies them as susceptible or sensitive. Various groups living under severe poverty have developed coping and adaptive capacities that are acknowledged in the literature and this we consider with the differentiation of these criteria.
273	65540	19	12	10	12	10	The source Garschagen 2011 (online first) is now published in print and can be changed to: Garschagen, M. (2013). Resilience and Organisational Institutionalism from a Cross-Cultural Perspective – An Exploration based on Urban Climate Change Adaptation in Vietnam. In: Natural Hazards, 67(1): 25-46. (Matthias Garschagen, United Nations University)	This has been modified.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
274	63701	19	12	11	12	17	Again, there is a partial overlap with criteria 2, 4 and 5 - line 14: "implying that the capacities to cope or adapt are low"). (GERMANY)	There is a certain overlap, however, the emphasis on this criteria are the "conditions that are hard to change" - it is about the presistence of susceptibility/sensitivity and low coping or adaptive capacities. For example a group can have a high level of poverty, but if this group has means to get out of it rather rapidly after an extreme event it is less problematic compared to groups that face a high level of poverty that is chronic - hence chronic poverty - which is hard to overcome.
275	63702	19	12	13	12	13	Tipping points might not only be crossed by hazardous events but also by trends. Again this text concentrates too much on the risk perspective of hazards and events. (GERMANY)	Ok we modified the text, however, please also note that we acknowledge trends under our definition of hazards.
276	79776	19	12	16	0	0	The issue of soil conditions (fertility? Quality?) is brought up in this point but never revisited in detail in the rest of the chapter (Jessica Gutknecht, Helmholtz Centre for Environmental Research-UFZ)	Please see similar comment and response (comment 268)
277	62957	19	12	16	12	17	For additional relevant references on tipping point, please see: Shen, X. ; Downing, T. (2010) (Eds.): Tipping Points in Humanitarian Crisis: From Hot Spots to Hot Systems. SOURCE No. 13. UNU-EHS. Bonn. (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	The UNU-EHS Source is a good vademecum for various aspects of tipping points, however, most papers still discuss tipping points as a conceptual issue. The source Renaud provides precise data on a case study and therewith underlines that these different notions of tipping points exist. However, the UNU-EHS Source is also a valuable document and provides different conceptual perspectives on the topic of tipping points.
278	62951	19	12	18	12	24	With respect to infrastructure failures and the problems arising from complex and multiple-interacting systems it is referred to Chpater 23 (Europe). Chapter 23 however is only one regional example; different infrastructure sectors are also addressed in other regional chapter, e.g. Chapter 26 (Northamerica) or 24 (Asia) to different extents. However, none of the regional chapters tackles the vulnerabilities that arise from increasing human dependencies on the functioning of these systems (at least in developed countries) as well as the systems' own vulnerabilities to Climate Change and different extreme events that might lead to cascading effects an thus large and cross-sectoroal failures. (Claudia Bach, United Nations University Institute for Environment and Human Security)	We have cited additional literature that makes these points.
279	63703	19	12	18	12	24	This criterion could be slightly different than the others as it focuses particularly on external stressors, this should be made clearer. And you may want to take out "chronic poverty" in this regard, as this is not really an external stressor. (GERMANY)	The challenge here is that we want to present context conditions that characterize vulnerability of systems or people exposed, this is not equal to stressors or hazards.
280	84363	19	12	19	12	21	It would be useful to cross-reference discussion of these issues in Chapter 13. (Michael Mastrandrea, IPCC WGII TSU)	Inadvertently omitted, will be added before final publication.
281	84364	19	12	22	12	24	It seems a bit strange to cite only one regional chapter on this general point. Chapter 26 also discusses these issues to a certain extent, as do Chapters 8 and 10. It would be useful to expand the cross referencing (to specific chapter sections) here. (Michael Mastrandrea, IPCC WGII TSU)	We have made a reference to Table 19-4 which contains more information on this and respective cross references to other chapters.
282	63704	19	12	29	12	31	Key risk are also risks from climate changes (not only hazards) with low magnitude such as temperature increase. On some systems only small changes in temperature can have major effects (i.e. coral reefs). (GERMANY)	Yes, we acknowledge this point now more precisely, e.g. in the key risk tables (CC-KR and Table 19-4)
283	80549	19	12	30	12	30	This is an important definition and I support it. A risk does not need to have high probability in order to be key - medium probability is fine, it just needs to not be low. This needs to be borne in mind elsewhere in the chapter when making confidence statements - sometimes there are statements of high confidence that do not seem well-grounded in literature (eg: impacts outpacing adaptation for warming above 2 degrees). A lower confidence statement may be more approprite and would still be relevant to policymakers. (Richard Betts, Met Office Hadley Centre)	We have tried to align the confidence language with this concept.
284	77711	19	12	31	12	31	Is "not" missing ahead of "affect"?? (Francis Zwiers, Pacific Climate Impacts Consortium)	No, a 'not' is not missing in the sentence, however, due to the need to shorten the chapter we have deleted this sentence.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
285	63705	19	12	33	12	35	Trends do not have a frequency! What do you mean with severity (or intensity below point 4) in contrast to magnitude? (GERMANY)	The sentence has been modified; magnitude, frequency and intensity are now mentioned.
286	77712	19	12	33	12	36	As with the criteria for key vulnerabilities, a few words on how the criteria for key risks are used would be helpful. For example, is it necessary that only one of the criteria be satisfied to judge whether a risk is key, or should multiple criteria be satisfied? If so, are all weighted equally? A few words on the extent to which the criteria evaluate things that are inter-related would also be helpful. (Francis Zwiers, Pacific Climate Impacts Consortium)	The question on how we used and applied the criteria is answered with a paragraph just before Section 19.2.2.2
287	77713	19	12	36	12	37	In evaluating magnitude, presumably economic loss should be measured in relative terms (relative to the size of the economy of the society that is at risk). (Francis Zwiers, Pacific Climate Impacts Consortium)	Yes, economic losses could be measured in absolute numbers or in a relation to GDP etc. This depends on the focus of the assessment.
288	63706	19	12	36	12	38	Are environmental losses without effects on humans not considered here? Please include them, because maybe a link is not known yet. (GERMANY)	Environmental losses without any consequence for humans are not considered as key risks. If - however - the environmental good or loss has a certain value for humans then it could be considered as key.
289	77714	19	12	36	13	8	The description of these criteria seems to be a slightly uneven. Some criteria describe the metric that will be used separately from the criterion that will be applied to that metric (e.g., criterion 2), while others (such as 4), combine the metric and the criterion in a single statement. As noted previously, I like the former approach a bit better. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have modified the criteria.
290	82976	19	12	41	12	43	It would be great if the chapter team, in its summaries of key risks, could further indicate risks materializing in the near term versus the distant future. (Katharine Mach, IPCC WGII TSU)	We do this in the context of the RFCs. At the level of the summary of the key risks, it is quite difficult to define which risks are rather near term and which risks are rather occuring in the long-run. This also depends heavily on the region and the future governance, e.g. Risk governance in urban areas in e.g. South-East Asia and Asia, where the highst rate of future exposure to climatic hazards is expected (e.g. IPCC 2012; Peduzzi et al. 2012; Birkmann et al. 2013).
291	84365	19	12	41	12	43	Another way that risks materializing in the near term vs. long term may be evaluated differently is in terms of the potential for mitigation to reduce them, given the inertias in the climate system and in societal systems. This timing of materialization is also relevant to criteria 4 below, and could be referenced there as well. (Michael Mastrandrea, IPCC WGII TSU)	We discuss this characteristic in point 2 of 19.6.2.2.
292	79976	19	12	44	13	2	Loss of biodiveristy and the ecosystem services supported by biodiversity must surely be key risks as these are often irreverible. This should be mentioned here. (NORWAY)	Yes, this is mentioned now with some examples in the Table 19-4 - see also the icon on environmental vulnerability.
293	84366	19	12	53	13	2	Again, it would be useful to cross-reference discussion of these issues in Chapter 13. (Michael Mastrandrea, IPCC WGII TSU)	Inadvertently omitted, will be added before final publication.
294	74184	19	13	4	13	4	Suggest omitting "and the vulnerability of societies and social-ecological systems exposed" as it is somewhat inconsistent with the text that follows, and may be sufficiently addressed already on Pages 11 and 12. (UNITED STATES OF AMERICA)	We strongly disagree, scientific literature underscores that one could have the ability to reduce the magnitude and frequency or nature of hazardous events linked to climate change, but still would still not be able classify this as a key risk, since the ability to reduce vulnerability would be still there and consequently the risk would not be key. Solely if the capacities are limited for both - 1) reducing hazard magnitude, frequency etc. AND 2) the vulnerability - we define this as a criteria for key risk.
295	76777	19	13	6	13	6	Intensity of risks has not be defined earlier, and the difference with magnitude is not so clear (Nicolas Desramaut, BRGM)	Sentence has been modified - now we underscore the intensity of the hazard.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
296	80550	19	13	11	13	24	This section should also discuss risks which are becoming less of a concern, eg: global-scale drought (see Sheffield et al, Nature, 2012/2013) and Amazon die-back (Good et al, 2013). NB Reducing concern does not necessarily mean these risks should be dismissed - a careful, balanced, objective discussion is needed to assess the current status of evidence and whether the risks are still "key" even if now thought to be of lower probability or magnitude, or affected by other processes. (Richard Betts, Met Office Hadley Centre)	This section still is providing a guideline for the assessment of different risks which are discussed later in the chapter. Hence, at this moment we want to use just examples that are the most illustrative cases for key risks. Other issues are captured in other parts of the chapter. The examples used are mainly an illustration of the new systematization.
297	63076	19	13	13	13	13	Is this really the definition you want to go with for emergent risks? It is very abstract, unspecific and probably not very useful. You may want to consider whether right in the first sentence of the definition you could include the notion of an emergent risk havig a relation to something unprecedented, something that emerged recently, etc. (as indicated further below) (Christian Huggel, University of Zurich)	We carefully considered several different approaches to definitions and decided to stick with this one, based on our understanding of the intent of the plenary-approved outline. Risks which are entirely new (or for which sufficient information now exists to provide assessment) are treated in 19.5.
298	77715	19	13	13	13	24	Is it necessary to give these definitions a second time? (Francis Zwiers, Pacific Climate Impacts Consortium)	We shortened this paragraph
299	63707	19	13	29	13	29	Please consider the relation between climate change and physical impacts right: change into " .. Interaction of climate changes and its physical impacts with ..." (GERMANY)	We have modified this text to refer to climate-related hazards rather than to physical impacts, to be consistent with terminology in the rest of the chapter.
300	82977	19	13	29	13	30	If this statement is retained, should exposure be reflected as well? (Katharine Mach, IPCC WGII TSU)	Yes, we have added mention of exposure.
301	82978	19	13	33	13	39	It seems these statements could be merged or, at least, overlap reduced. (Katharine Mach, IPCC WGII TSU)	Agreed. The paragraph beginning on line 37 has been edited to reduce overlap with the preceding paragraph.
302	61471	19	13	39	13	39	"and consequently on climate change" - is this clause necessary after the mention of emissions and other forcings? This section also needs careful copy-editting. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have modified text in this paragraph for clarity, and removed this clause.
303	63708	19	13	45	13	47	This sentence ("The size or scale of populations...") does not provide any new information, as it mentions very general aspects, which are logically already covered through the before mentioned development pathways. (GERMANY)	We have edited this sentenced to make clearer its contibution, which is to describe aspects of development pathways that contribute to the aggregate scale of the risk, rather than to its particular nature.
304	77347	19	14	4	14	14	An essential aspect of analysing vulnerabilities is the validation of indices, vulnerability patterns and other findings. Newer approaches test the consistency of findings against independent data sets of observed vulnerability outcomes (e.g. Fekete 2009, Sietz et al. 2012). The outcome-based validation presented in Sietz et al. (2012) constitutes a crucial step in establishing the credibility of findings and hence their suitability for informing extension services and individual decisions. REFERENCES: Fekete, A. (2009) Validation of a social vulnerability index in context to river-floods in Germany. Nat. Hazards Earth Syst. Sci. 9: 393-403. --- Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2012) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Regional Environmental Change 12(3): 489 - 505. (diana sietz, Wageningen University)	The section rather refers to the question of how to apply the criteria developed out of the scientific literature. This point is important, since some reviewers mentioned that there is too little information on how we actually apply and one can use the criteria. The relevant literature of Diana Sietz is cited in other places.
305	63709	19	14	6	14	6	Please include also climatic trends, not only events! (GERMANY)	See comment to former points on this and definition of hazards in our glossary in the chapter.
306	63710	19	14	11	14	11	"INTERNAL conditions" instead of inner conditions (GERMANY)	Point has been taken into account.
307	82979	19	14	24	14	29	Would it be clearer to be more systematic about usage of "risks" versus "vulnerabilities" here? As is, logic of the usage may not be completely clear. (Katharine Mach, IPCC WGII TSU)	We have clarified the use of risks versus vulnerabilities in the text.
308	77716	19	14	26	14	26	I think it would be better to express this assessment in confidence language given that interaction processes are described in general terms, and the criteria for determining a key vulnerability involve subjective judgements. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have inserted some confidence statements in 19.3.1.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
309	84367	19	14	27	14	29	The quantitative basis for the probabilistic "likely" here is not clear. This context may be better suited to a confidence assignment. In addition, is there a reason why emergent risks are not mentioned explicitly in this sentence, while they are in line 24 where the interactions are also referenced? For clarity, it may be useful to mention the term here as well. (Michael Mastrandrea, IPCC WGII TSU)	We now include a discussion of emergent risks and remove the use of 'likely.'
310	74185	19	14	32	14	34	There is little to no discussion in this chapter regarding the impacts of climate change on modes of climate variability (e.g., ENSO) and how those impacts do and can have profound effects on risk and vulnerability in many locations. While an extensive treatment of the change-variability linkage may not be warranted here, one or more paragraphs identifying the importance of interannual systems of variability such as ENSO and AO to risk and vulnerability would strengthen the chapter. (UNITED STATES OF AMERICA)	There is insufficient literature to assess risks related to modes of climate. More generally this is subsumed under various aspects of climate variability.
311	62952	19	14	32	14	37	All other points listed under 'Limitations of Previous Apply Key Risks Overlooked' have seperate explanatory subchpaters. (Claudia Bach, United Nations University Institute for Environment and Human Security)	Sorry, we did not understand this comment.
312	61472	19	14	33	14	33	The phrase "preconditions these systems" is too vague and needs refining (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have reworded this sentence.
313	84368	19	14	33	14	33	It is not completely clear what "preconditions these systems" means here. Does this mean something beyond increasing vulnerability to the effects of mean climate change? (Michael Mastrandrea, IPCC WGII TSU)	We have reworded this sentence.
314	80552	19	14	35	14	38	Also include interactions with mitigation actions eg: bioenergy (Richard Betts, Met Office Hadley Centre)	Interactions with mitigation and bioenergy are dealt with in sections 19.3.2.2. and 19.4.1.
315	76778	19	14	39	14	39	The interaction between climate change and disease emergence could be more detailled, like the others bullet points for the other interactions. (Nicolas Desramaut, BRGM)	We did not have space to expand this here.
316	77717	19	14	39	14	39	"Interactions related to" doesn't make if very clear what is interacting with what - sounds like the nature of one or more interactions (unspecified) might be affected by climate change or disease emergence, as well as disease emergence being affected by climate change (in addition to other processes that might facilitate disease emergence, such as globalization). I think a few more words are required to make this more specific. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have reworded this sentence.
317	77718	19	14	42	14	43	I suggest deleting the last bit "in cases where …" - water stress on wetlands would, presumably, affect a host of ecosystem services provided by the wetlands. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have rephrased this paragraph.
318	82980	19	14	46	0	0	Section 19.3.2. In revising the section, it would be great if the chapter team could indicate how risks differ with levels of climate change, socioeconomic/climate scenarios, and time frames, where possible. (Katharine Mach, IPCC WGII TSU)	In rewriting this section, we have created links with various levels of global temperature rise or RCP trajectories where possible. The limited literature on complex interactions does not allow for an extensive analysis of this dependence.
319	63711	19	14	48	0	0	Section 19.3.2.1 is "only" a enumeration of impacts of cc on ecosystem services. I did not have the chance to check the whole report, but looking at the TOC I am sure that all this information should be already given in more detail in other chapters. Thus, you could only refer to these chapters (maybe have an overview table of impacts on ES) and make the report a bit shorter and more concise. (GERMANY)	There is now ample cross chapter referencing and given the centrality of this section to the chapter we do not think it should be shortened.
320	79977	19	14	48	16	20	Many of the risks and effects associated with biodiversity and ecosystems have been obvious and apparent too long to be called emerging risks instead of key risks (and they are actually stated to be key risks in chapter 19, p 15, l.48-49 and 19.6.2.1 - ma (NORWAY)	We agree and include ecosystem service los in our list of key risks in Table 19-4. We also changed to our wording to key risk. Note that we have in any case changed definition of emergent to mean a result of complex interactions, but for clarity and space reasons this is not discussed here.
321	82981	19	14	51	14	54	For what scenarios and assumptions was this projection made? (Katharine Mach, IPCC WGII TSU)	We have now detailed the scenarios is A1B

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
322	84369	19	14	52	15	2	It is not completely clear whether the projected percentages of species represent those for which their new climatic range is less than 50% of the size of their current range (whether or not the new area falls within their current range), or whether this is only looking at the change in the current climatic range without considering expansion into new areas (e.g., including species that lose more than 50% of their current range but gain the same area in "new" climatic range). Clarification would be helpful. And finally, are these projections for a specific emissions scenario? (Michael Mastrandrea, IPCC WGII TSU)	It is a greater than 50% loss of range size, that is the newly occupied areas are also included. Species are allowed to disperse at realistic rates corresponding to observations: thus, much of the area that becomes newly suitable is not yet occupied by the end of the century, because species cannot keep up with the velocity of climate change. The text has been reworded in section 19.3.2.1 to include this detail.
323	77719	19	14	53	14	53	What do the uncertainty ranges (+/-6% and +/-7%) represent? Are these one standard deviation, some kind of confidence interval, some other kind of range?? Also, replace the ambersand with a word. (Francis Zwiers, Pacific Climate Impacts Consortium)	The uncertainty ranges refer to the use of different GCMs to project regional climate change patterns. For instance, precipitation as well as temperature is an important determinant of species climate envelopes and spatial patterns of precipitation change in response to increased radiative forcing differ significantly between GCMs. There is no space to explain that in the text
324	57644	19	14	54	14	54	Do you really want to hang such a specific and contentious statement on Warren / not an ecologist and paper yet to vetted and to be published in an undisclosed journal? (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Literature is assessed by its quality not upon who wrote it. For the record actually Warren does have qualifications in biology and ecology and so do most of the coauthors on that paper.
325	82982	19	14	54	15	2	The chapter team should consider parenthetical presentation of the level of confidence, to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	The confidence statement is now in brackets as requested
326	82983	19	15	2	15	2	It would be preferable to provide specific line-of-sight reference to the relevant sections of chapter 4. (Katharine Mach, IPCC WGII TSU)	This is now cross referenced to section 4.3.2.5 as requested
327	80416	19	15	3	15	4	The sentence is currently unclear. Please revise and place the matching WGI AR5 reference correctly. (Gian-Kasper Plattner, IPCC WGI TSU)	The sentence has been reworded to clarify it and the cross references to WG1 have been checked and updated
328	57761	19	15	14	15	29	this is an interesting paragraph, but I'm still left wondering whether there are possible counterexamples of areas where pests become less problematic. In other words, is a synthesis statement such as "low confidence that climate change will increase risk of large pest or disease outbreaks" possible, or is that too far? also, a reference that might be added to this list is on spot blotch in wheat Sharma, R., Duveiller, E., & Ortiz-Ferrara, G. (2007). Progress and challenge towards reducing wheat spot blotch threat in the Eastern Gangetic Plains of South Asia: is climate change already taking its toll? Field Crops Research, 103, 109-118 (David Lobell, Stanford University)	This section has been rewritten by cross referencing to Ch 7 and hence your point is addressed. Since we are talking about risks and not projections, we still identify this as a potentially key risk. (If there were no uncertainties in our understanding of the system, and if changes in crop pests had already been attributed to climate change, it would already be a key risk)
329	77720	19	15	31	15	45	Here is an example where there is considerable reporting of information from the literature, but not necessarily a critical appraisal (assessment) of its robustness. The subsequent assessment in lines 47-49, that the large costs reported illustrate the vulnerability of human systems, should be nuanced to recognize that the cost estimates themselves must be very uncertain (including due to methodological uncertainties). This is reflected to some extent in the text (e.g., for the recreation value of ecosystem services in US forests - where the cost range seems to be effectively anything up to $100 billion), but I think deserves to be more strong emphasized. (Francis Zwiers, Pacific Climate Impacts Consortium)	We are not able to assess the robustness of all of the exact numbers quoted in the citations relating to ecosystem service valuation. We do know however that the NEA (2011) work is based on extremely detailed and rigorous analysis and therefore feel that this is robust in magnitude. However, more generally as a wide range of authors have arrived at a wide range of high values, we feel that the statement that the large economic impacts estimated by a wide range of authors now allow us to identify ecosystem service loss of various types as a key risk, because the magnitude of the projected impacts is large irrespective of uncertainties in precise values.
330	71404	19	15	31	15	49	Suggest that all money values be presented in consistent currency. (CANADA)	Whilst this would be useful we feel it is better to simply quote the values provided by the literature. It is better not to run into debates about the use of market exchange rates or purchase power parity in currency conversion, for example.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
331	84370	19	15	31	15	49	It might be useful to consider presentation of this information in a table to inform the discussion here and in 19.6.3.5. (Michael Mastrandrea, IPCC WGII TSU)	We have now created a table to summarise these results as requested
332	57762	19	15	34	15	34	"Climate change impacts on pollinators therefore places these valuable services at risk." what confidence to you put on this statement? Seems like causes of pollinator declines are not well understood and impacts of climate are low confidence at best. (David Lobell, Stanford University)	This whole section has been revised by cross referencing to Ch 7. We did not feel able to place confidence statements.
333	79979	19	16	5	16	6	Please consider reflecting this finding also in the TS and possibly in SPM. (NORWAY)	We have bullets in the Table 19.4 which appears in the TS about the problems of loss of ecosystem services of various kinds.
334	80553	19	16	8	16	13	This paragraph should note that land use change and fragmentation increasingly arises from climate change mitigation policies (bioenergy, large-scale solar farms on green fields) - policymakers need to be aware of unintended consequences of policies, especially if these consequences may be as significant as some of the impacts that the policies are intended to avoid. (Richard Betts, Met Office Hadley Centre)	We discuss unintended consequences of policies, but were not able to find literature supporting a relationship between fragmentation and mitigation, as opposed to general deforestation
335	77721	19	16	15	16	16	Is it true that old growth forests accumulate carbon? I couldn't find a place in either the WGI or WGII draft reports where this is assessed, and literature apart from Luyssaert et al, 2008, seems to be limited. This is an example of a statement where a critical appraisal would be helpful. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have generalised our statement now using old growth forest as an example
336	79978	19	16	15	16	16	"such as old forests" is not a good example in this context. Old forests holds large carbon stocks, but does not contribute much to accumulate carbon compared to younger and more productive forests. (NORWAY)	We have generalised our statement now using old growth forest as an example
337	80554	19	16	15	16	20	Land use change also affects climate through biophysical effects (changes in albedo, evaporation, etc) - this should be mentioned here. (Richard Betts, Met Office Hadley Centre)	We agree and now mention this at the end of the section 19.3.2.1
338	63712	19	16	23	0	0	For section 19.3.2.2 I see the same problems as for the previous section that topics should already be covered in more detail in other chapters of the AR5. (GERMANY)	The purpose of this chapter is to provide a synthesis across chapters and therefore to draw additional insights not present in the individual chapters. We cross reference material where it appears in other chapters.
339	84380	19	16	23	0	0	Section 19.3.2.2: Consider the discussion of similar topics in sections 19.4.1 and 19.4.3.1, as well as ways to reduce overlap. (Michael Mastrandrea, IPCC WGII TSU)	Thank you for the suggestion. Considerable care was taken to cross-reference other chapters in these sections as a way to reduce overlap.
340	79980	19	16	23	17	6	As with loss of biodiversity and ecosystem function, many of the risks associated with land, water and energy use by humans have been obvious and apparent too long to be called emerging risks instead of key risks, please consider changing the wording. (NORWAY)	We have reworded the text.
341	62953	19	16	23	17	41	The failure of infrastructure and their interconnectedness has not been addressed. A new emergent risk which is hardly addressed in the current literature is on increasing interconnectivity and complexity (see. e.g. Rinaldi 2001). This interconnectivity can lead to cascading effects (ibid. or Kröger 2008) including economic consequences (compare GAR 2013) of failures caused by either gradual change such as seasonal shifts in energy demand peaks (compare Hekkenberg et al. and also Chapter 23) or water shortages (Rübbelke and Vögele 2011) as well as extreme events. Additionally, mitigation measures and the restructuring of many infrastructures also offer great potential on the reduction of the mentioned systemic risks (e.g. Sperling et al. 2011). (Claudia Bach, United Nations University Institute for Environment and Human Security)	These aspects are now covered in our Table 19-4 on key risks, items iv and v
342	80555	19	16	28	16	29	"Failure to manage land...." point out that this includes land management as part of climate change mitigation, eg: bioenergy (Richard Betts, Met Office Hadley Centre)	The text has been reworded as requested.
343	80417	19	16	32	16	33	Please be more specific regarding "projected changes in climate variability" and provide a cross-reference to WGI AR5. (Gian-Kasper Plattner, IPCC WGI TSU)	Cross reference to AR5 WGI added as requested
344	74186	19	16	32	16	41	Unstated in this paragraph is the further complicating issue of decision-making by individuals and communities that prioritizes economic well-being above water availability, e.g., "cash crops". This may be worth addressing briefly. (UNITED STATES OF AMERICA)	Thank you for the suggestion. Unfortunately we did not have space to expand this section any further.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
345	77722	19	16	43	16	43	I'm concerned that the assessment here has the potential to become a "hostage to fortune". "Likely" implies that there is a substantial evidence basis, and that there is high confidence. But the statement points to Barnett et al (2008), which is a detection and attribution study that considers historical change in snow pack and streamflow in a limited region in the western United States. I would not regard this as a basis for a statement on the availability of future surface water resources, either regionally, on more broadly as seems to be the application here. (Francis Zwiers, Pacific Climate Impacts Consortium)	The text has been edited to remove the word 'likely' and the reference to Barnett et al., 2008 has been removed.
346	84371	19	16	43	16	43	The quantitative basis for the probabilistic "likely" here is not clear. This context may be better suited to a confidence assignment. (Michael Mastrandrea, IPCC WGII TSU)	Please see comment 345.
347	84372	19	16	43	16	45	The cited Barnett et al paper is focused on the Western US, while it is paired here with a general, global statement. The examples mentioned in this paragraph seem to support a global statement, but I would suggest splitting out the reference to Barnett et al as another regional example for clarity. (Michael Mastrandrea, IPCC WGII TSU)	Please see comment 345.
348	77723	19	16	43	16	54	This is another example of text where there seems to do lots of reporting, but where there could be more critical appraisal. For example, on line 51, we are told that "One projection shows …" - why should we pay attention to, and have confidence in, that one projection? Are there methodological and other uncertainties that readers should take into account before taking note of that study? (Francis Zwiers, Pacific Climate Impacts Consortium)	Please see comment 345.
349	74187	19	16	43	17	6	One thing that is missing from this section is a recognition that existing governance constraints (e.g., water rights treaties) may be barriers to efforts to reduce vulnerability. (UNITED STATES OF AMERICA)	the text has been reworded as requested.
350	57621	19	16	45	16	47	"For example, following a ten-fold increase in groundwater extraction in China, 70% of the irrigated cropland in China is now groundwater fed, and it is estimated that 0.5% of the country's greenhouse gas emissions are attributable to exploitation of this resource(Wang et al., 2012)."The sentence that 70% of the irrigated cropland in China is now groundwater fed is not accurate, because in the reference (Wang et al.2012),the region is North China not whole China. And the result is concluded based on only 11 provinces in China which can't represent the whole China. In text,this example can't support the view of the first sentence in this paragraph. Based above mentioned reasons, I suggest to delete this sentence. (GE GAO, National Climate Center,China)	This sentence has been deleted as suggested.
351	61473	19	16	45	16	47	This sentence is interesting, but it's not immediately clear how it relates directly to the point introduced in the paragraph's opening sentence about increasing groundwater extraction as a response to climate change. Further on in the paragraph, it would be useful to have some examples to illustrate the point that different places are seeing different directionality in recharge trends. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	the text has been reworded as requested
352	77724	19	17	3	17	3	What is the issue? (Francis Zwiers, Pacific Climate Impacts Consortium)	This text has been clarified and now clearly discusses the interactions between water use in the energy sector and water stress in arid regions.
353	77725	19	17	5	17	6	It seems to me that it is necessary to more than just report on the existence of these other studies. (Francis Zwiers, Pacific Climate Impacts Consortium)	the text has been reworded as requested.
354	69870	19	17	8	17	9	It would perhaps be clearer to state that these scenarios (referring mainly to RCP2.6) are consistent with projections which limit global mean temperature increases to around 2C by the end of the 21st Century. (John Caesar, Met Office Hadley Centre)	2C clarification has been added.
355	61474	19	17	9	17	9	Could the authors elaborate on the "economic necessity" of biofuels in simulated stringent mitigation pathways? Anything labelled as a necessity, particularly an economic one, is usually underwritten by contestable assumptions and value-judgments. It isn't really necessary to unpick the study cited here, but a brief elaboration or re-wording would be useful (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Wording has been revised based on this comment.
356	57804	19	17	16	0	0	is projected to lead to large scale deforestation - Caveat missing. What is the likelihood of such an event? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have reworded the text to reflect the fact that large scale deforestation is a projected consequence.
357	61475	19	17	18	17	20	Need to give a complete and balanced view of the issues of using biofuels as a mitigation strategy. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have reorganized the chapter text to focus more on potential climate impacts from biofuel development as a mitigation strategy. Risks of pursuing this mitigation strategy are summarized in Table 19-2.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
358	57805	19	17	18	17	22	How could a tax on land use emissions work when we cannot measure such emissions? I wish we had reliable large scale LU emission measurements. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Qualifying text added based on this comment.
359	79981	19	17	18	17	23	This is not consistent with WGIII Ch. 6 and 11. We doubt that the achievement of the 450 ppm-550 ppm stabilized concentration of GHG in the atmosphere goal will lead to "deforestation of all natural forest". Natural forests cut and replaced by new forests (NORWAY)	We have coordinated with WGIII on these sentences and revised them according to their input.
360	79982	19	17	25	17	33	COMMENT: According to article 2 in the climate convention, the overall climate goal is to stabilize the GHG concentration in the atmosphere at a level that prevents dangerous interference with the climate system. The relevant timescale for such stabilizat (NORWAY)	Truncated comment - unclear what action is being requested.
361	80556	19	17	25	17	33	Mention potential impacts of biofuel plantations on biodiversity here. (Richard Betts, Met Office Hadley Centre)	Biodiversity impacts from biofuels are now included as a separate line item in Table 19-2.
362	63713	19	17	47	0	0	For section 19.3.2.3 I see the same problems as for the previous section that topics should already be covered in more detail in other chapters of the AR5. There is a whole chapter on human health! I do not see the point in making the report longer by repeating facts. (GERMANY)	This section has been shortened to accommodate your request and cross references have been made to other WGII chapters.
363	61476	19	18	2	18	3	It is difficult to follow the causal chain being posited in this sentence about the emergent risk of malnutrition. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The sentence works up the causal chain, and not down it, since the risk being presented is malnutrition, it is presented first.
364	61477	19	18	9	18	11	Could this statement be linked to the broader literature on the possible future direction of rainfall trends in the Sahel? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	It could be linked to rainfall trends in the Sahel but linking this statement to impacts on malnutrition would require more literature that takes into account the variability on impacts on Sahelian communities that have different agricultural practices and vulnerabilities to these climate (precipitation) impacts
365	61478	19	18	19	18	20	It is not immediately clear how this risk counts as an "emergent risk" given the definition used in this chapter. Also, mention could be made of the behavioural aspects of such health impacts, on which there is a growing literature. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The statement has been clarified to relate specifically to heat mortality in urban areas.
366	57806	19	18	27	18	30	1C increase leading to more hospital stays - I think this would only apply to the summer. Correct? In winter, a 1C increase may lead to fewer hospital stays (less ice) in NYC. More is needed here. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Clarified by specifying "summertime temperatures"
367	74188	19	18	27	18	30	Here - as in elsewhere in the chapter - the literature cited does not necessarily support "robust evidence" for impacts beyond a specific case study. For example, 1C increase leading to more hospital stays - Would this only apply to the summer in NYC? This is representative of the negative rise bias that pervades throughout the chapter. (UNITED STATES OF AMERICA)	This section on health in this chapter is intended to illustrate emergent risk in the context of health. A more comprehensisve treatment of this topic, discussing a broader evidence base is presented in Chapter 11 (Human Health).
368	77726	19	18	30	18	31	I think it is necessary to assess the mechanism that is involved. For example, the suggestion that tropospheric ozone will increase seems to be at least somewhat at odds with the assessment that is given in WG1 AR5 Chapter 11 (see 11.3.5.2.1). The SOD summary on tropospheric O3 from that chapter states "Overall, there is high confidence that a warming climate will change baseline O3 levels by reducing tropospheric O3 as water vapor rises with temperature, increasing the O3 chemical loss rate in much of the unpolluted lower troposphere. Both evidence and agreement are more limited regarding the impact of climate change on pathways for long-range transport of air pollution or the feedbacks from emissions from the biosphere, leading to low confidence in their potential importance for future air quality." (Francis Zwiers, Pacific Climate Impacts Consortium)	Language modified to specify urban areas. The potential for decrease in tropospheric ozone as a function of temperature noted in WGI relates to background, global concentrations.
369	61479	19	18	47	0	0	A really interesting point made about lack of consideration to interactions itself constituting an emergent risk. A discussion of this is promised in 19.6.x on governance - this is not evident at present. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	It is unclear what this comment is referring to.
370	77727	19	18	53	18	53	Insert "are" before "apt". (Francis Zwiers, Pacific Climate Impacts Consortium)	Corrected.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
371	74189	19	18	54	19	3	Example of flood impacts on various sector is not an extraordinary convergance of multiple impacts. Floods commonly affect crops, health, water and many other systems leading multiple impacts with or without climate change impact. A better example might be successive hazards or shocks hitting the same area without much time to recover and overwhelming capacity on the ground. A good example is 2000 Mozambique floods (feb 8) combined with cyclone Leon-Eline (feb 22) that had significant impact on agriculture, infrastructure, health and many other impacts. Another good example is 1997/1998 El Nino event: floods in Kenya leading to Rift Valley Fever breakout in the Greater Horn of Africa. The event caused ban on livestock by Saudi Arabia from the eastern Africa which led to significant impacts on livestock prices, economies and livelihoods of many pastrolists and others involved from Egypt to Yemen. (UNITED STATES OF AMERICA)	Thank you for the examples. However, the purpose of this paragraph is just to explain the definition and concept of "area of compound risk" with a simple example. In order to keep the explanation as simple as possible, we will use the original example.
372	77728	19	19	5	19	9	Should there also be a mention of evaluations of climatic hotspots? (e.g., the recent paper by Diffenbaugh and Giogi on hotspots diagnosed from CMIP5 - Climatic Change, doi:10.1007/s10584-012-0570-x. (Francis Zwiers, Pacific Climate Impacts Consortium)	In the FGD, we have decided not to use the term 'hotspot' in order to avoid confusions with various meanings of 'hotspot' - the text has been revised accordingly.
373	74190	19	19	5	19	15	The importance of a regional perspective in identifying and assessing multi-impact hot spots could be stressed even more in this paragraph. The example of a river basin comes to mind, which is a physical system with exposure to climate impacts that also supports economic and ecological services. Many river basins also have complex governance issues and constraints. This is just one example of how a regional perspective can be useful in a discussion of hot spots. (UNITED STATES OF AMERICA)	It has been additionally mentioned that areas of compound risk identified by overlaying spatial data on impacts in multiple sectors can be used as a starting point for regional case studies on vulnerability and multifaceted adaptation strategies.
374	80557	19	19	15	19	15	ISI-MIP does include relevant material - include a more specific citation here (eg: Piontek et al, submitted to PNAS). Parry et al (2004) pre-dates AR4 so unless it was not cited in AR4, which seems unlikely, it does not seem necessary to cite it here. (Richard Betts, Met Office Hadley Centre)	Piontek et al. (2013) has been additionally referenced.
375	80133	19	19	17	0	0	Figure 19-2: European forests: here storm as key factor is missing as storm is the main risk agent in many European countries, storm damages result in often tremendous amount of salvage wood to be harvested in short term resulting in rapidly declining wood prices Regarding climate change impacts on socio-economic systems, two important aspects of how storms affect forestry and forest based industries have to be taken into consideration. The first is the effect on roundwood prices; the second is the effect on roundwood procurement, because high amounts of salvage wood may decrease the potential availability for future harvests (Schwarzbauer & Rauch 2013, Rauch 2010). Additionally, a recent study (Rauch et al 2011) assessed long term effects of climate change effects (increasing storm damages and more frequent bark beetle outbreaks) on the wood supply for Central European conditions. In summary, the short term surplus wood supply after a storm event will be dominated by a significant reduction of harvest activities or even complete cessation in the same or the following year(s), leading to a supply shortage in the medium term. Literature Rauch, P. 2010. Stochastic Simulation of Supply Chain Risks in Forest Fuel Procurement. Scandinavian Journal of Forest Research (25): 574-584. Rauch, P., Hahn, H., Gronalt, M. and Schwarzbauer, P. 2011: RisikHo - Risiko im Versorgungsnetzwerk Holzbiomasse. Endbericht FFG Projekt 818852, Neue Energien 2020, bmvit. 48 (in German, English abstract). Schwarzbauer P., Rauch P. (2013): Impact on Industry and Markets – Roundwood Prices and Procurement Risks. In Barry Gardiner (ed.): Impacts of storms on European forests. What Science can tell us 2. European Forest Institute. 251-255. (Peter Rauch, University of Natural Resources and Life Sciences, Vienna)	Thank you for the information. However, areas of compound risk on Figure 19-2 are basically based on other sections of the report and we are not going to assess individual articles comprehensively here.
376	77729	19	19	17	19	18	The caption should give a links pointing to the locations of the traceable accounts supporting the identification of hotspots. (Francis Zwiers, Pacific Climate Impacts Consortium)	For clarity, we have added references to supporting sections to each of the entries on the map.
377	62958	19	19	20	19	22	For additional references on tipping point, please see: Shen, X. ; Downing, T. (2010) (Eds.): Tipping Points in Humanitarian Crisis: From Hot Spots to Hot Systems. SOURCE No. 13. UNU-EHS. Bonn (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	Here, tipping points are not discussed.
378	71405	19	19	20	19	39	Hotspots are an interesting and relevant concept in this chapter, but the discussions could be further bolstered, especially as they didn't seem to support the definition on page 18 very well, by demonstrating the cross-sectoral aspects. These examples seemed to focus on the high exposure of these places. (CANADA)	Expression of some entries have been revised to clearly show the compound risk and its main determinants (multi-impacts).
379	84373	19	19	20	19	39	As mentioned in the context of the ES, Sub-Saharan Africa is highlighted but is not discussed here (rather, in 19.5.1). It would be useful to include discussion here, at least additionally, for clarity. (Michael Mastrandrea, IPCC WGII TSU)	For clarity, we have added references to supporting sections to each of the entries on the map.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
380	57807	19	19	22	19	27	The Arctic is also a place where the S/N ratio of temperature changes is low relative to other locations. While the sea ice reduction in the Arctic has been attributed to GHG increase, the currect rate of decrease has not. Inferring that the current rate will continue into the future has a lot of uncertainty. These caveats need mentioned here. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Detection and attribution of the sea ice reduction is undoubtedly an important topic. However, here in the subsection on areas of compound risk, DA does not need to be discussed necessarily. Thus we have decuded not to mention the caveats indicated by the reviewer here.
381	82984	19	19	22	19	39	It would be much preferable to make the references to other chapters at the level of specific chapter sections. (Katharine Mach, IPCC WGII TSU)	We have added references to supporting sections to each of the entries on the map.
382	82985	19	19	27	19	27	Which Arctic ecosystems are at risk? It would be preferable to be more specific. (Katharine Mach, IPCC WGII TSU)	Revised to add specific examples.
383	82986	19	19	36	19	39	What is the timeframe for this projection? What climate/socioeconomic scenarios and other assumptions are relevant? (Katharine Mach, IPCC WGII TSU)	This sentence has been revised to provide the requested information.
384	71406	19	19	42	0	0	Spell out PESETA (CANADA)	Corrected.
385	62399	19	19	46	19	46	Chapter 19 - There is no full stop in line 46 after (Ciscar et al., 2011). (INDIA)	Corrected.
386	77730	19	19	47	19	48	This subsection seems to fizzle out and I think leaves unmet some of the expectations that are raised by its title. A summary evaluation might be useful. (Francis Zwiers, Pacific Climate Impacts Consortium)	This sub-section has been deleted.
387	82987	19	19	51	19	51	The glossary definition of maladaptation could be cross-referenced. (Katharine Mach, IPCC WGII TSU)	This sub-section has been deleted.
388	60106	19	20	0	0	0	The title should read: “Long-distance Effects of Climate Change Impact ...” (AUSTRALIA)	We decided to retain our original title to reflect the content of the section
389	66308	19	20	3	24	43	Although many of the core chapters are referenced here, there is no reference at all to Chapter 21, which has a separate section (21.4) on cross-regional phenomena (P30-36). There may be some insights from there, but perhaps the authors of these two chapters should consider how much overlap is merited, especially considering that these aspects are being covered in more detail in the core chapters. Obvioulsy chapters 19 and 21 have a particular angle on these issues, but there is still probably some redundancy. Chapter 21 contact person insisting on this extra work for himself is an individual called Carter. (Timothy Carter, Finnish Environment Institute)	We have discussed overlap between chapters 19 and 21 in the meeting in Bled, and have revised the text to reduce the overlap
390	84374	19	20	6	20	9	These lines of the intro are most relevant to 19.4.1 rather than a general introduction to indirect, transboundary, and long-distance impacts constituting emergent risks. Consider moving them to the next section, with a bit further introduction to the suite of topics covered in 19.4 here. (Michael Mastrandrea, IPCC WGII TSU)	We disagree and decided to keep the text in place.
391	82988	19	20	7	20	7	It would seem preferable to avoid the word "danger" here given the context of the chapter. Also, is not completely clear what is meant by "relying only on global trade"? Overall, should this example be moved to the relevant subsection? (Katharine Mach, IPCC WGII TSU)	This sentence has been removed.
392	58957	19	20	9	20	11	A short example or reference(s) to the adequate example(s) provided in sections developped afterwards in 19.4, could be provided here to the reader, in order to understand what is meant by "unintended consequences". (EVELYNE FOERSTER, BRGM)	We did not have space to include examples here.
393	78896	19	20	14	0	0	I realise and accept that Chapter 19 explicitly focuses on downside risks, but especially in section 19.4.1 I am wondering whether the authors should note that in some regions, transboundary effects can partly or even fully compensate domestic economic damages from reduced production. E.g. several studies in New Zealand (cited in chapter 25) indicate that increasing commodity prices will more than compensate for projected domestic declines in production. This would hardly weaken the overall thrust of this section but it would help strengthen the realisation that risks are distributed very unevenly, and that transboundary effects, rather than levelling them out, can further enhance uneven risks (i.e. rising commodity prices further increase food insecurity in some regions but add to agricultural incomes in others that export food). (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	This section is focused on how the interactions between climate change, commodity markets, biofuel production, and food prices interact to create an emergent risk of increased food insecurity. In general, Chapter 19 is focused on the evaluation of emergent risks, key risks, and key vulnerabilities in light of climate change. While the reviewer's comment is well-taken, it is out of the intended scope of the section and is material that is more appropriately covered in other sectoral and regional chapters (such as Chapter 25 and 7).

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
394	84381	19	20	14	0	0	Section 19.4.1: Consider the discussion of similar topics in sections 19.3.2.2 and 19.4.3.1, as well as ways to reduce overlap. (Michael Mastrandrea, IPCC WGII TSU)	Thank you. We agree and have taken considerable measures to remove overlap between 19.4.1. and 19.3.2.2. Any biofuels-related material in 19.4.1 now solely relates to implications for food prices, whereas the focus of the biofuels content in 19.3.2.2 is now largely on indirect land use change (iLUC).
395	61480	19	20	14	20	15	This title is a bit of a mouthful - could it be simplified by swapping one of the "impacts" for "consequences"? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We agree. We have shortened the title considerably to "Crop Production, Prices, and Risk of Increased Food Insecurity"
396	68120	19	20	18	20	21	“Food access can be inhibited by rising food prices, as demonstrated during recent price rise episodes that resulted from the combination of poor weather in certain world regions combined with a demand for biofuel feedstocks, increased demand for grain-fed beef in China, and historically low levels of food stocks (Abbot and deBattisti, 2011; Adam and Ajakaiye, 2012).” The example of China given in this conclusion is not appropriate. The two references involve a number of countries and regions. It is a garbled quotation to single out China. Moreover, it is not in line with the conclusions of the original literature to associate the increased demand for grain-fed beef directly with rising global food prices. “increased demand for grain-fed beef in China” should be deleted. (CHINA)	Thank you. We have changed the wording from "for grain-fed beef in China" to "grain-fed meat"
397	57763	19	20	20	20	20	not really for beef in China, more for meat in general (poultry, pork, etc) (David Lobell, Stanford University)	Please see comment 396.
398	63714	19	20	24	20	25	Here you explicitly refer to chapter 7, where all these issues are dealt with, and then you still provide 2.5 pages of information that should have been already given in chapter 7. I only checked a few references and already found strong overlaps between this section and ch.7. (GERMANY)	Thank you. We have taken considerable measures to reduce overlap with WGII Chapter 7. We have restructured the section by removing content reviewed in WGII Chapter 7, and instead cross-reference their assessments more specifically. We have also coordinated this and other agriculture-related material with Chapter 7 authors.
399	77731	19	20	27	20	27	This is another example of text where there seems to be reporting ("One study found ... Another study identified ..." etc), but not much critical appraisal. Since this is an assessment, critical appraisal of methodological and other uncertainties inherent in the information should be provide if at all possible. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you. We have removed considerable portions of the material that appeared in 19.4.1 from the SOD and instead include more cross-references to the assessments and confidence statements from WGII Chapter 7.
400	57764	19	20	27	20	28	not sure how you get "may have offset 30-years of technology related increases" from that paper. Perhaps you mean the "climate trends were partially offsetting yield gains from technology improvements and higher CO2 over the last three decades" (David Lobell, Stanford University)	We have removed this statement and much of the rest of the paragraph that it was a part of.
401	61481	19	20	27	20	44	Can confidence statements be offered here? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have removed much of this paragraph and instead refer to the assessments made on this material in WGII Chapter 7.
402	76891	19	20	27	21	18	The paragraphs need to cross-reference chapter 7. It is not the job of chapter 19 to review these evidences. (Food and Agriculture Organization of the United Nations (FAO))	Thank you. We have removed most of this material and as the reviewer suggested, instead refer to the assessments made on these topics in WGII Chapter 7.
403	57766	19	20	31	20	40	again I think the interpretation is a little off here. That study (or the lobell 2011) showed that climate trends over that period were more important in aggregate than CO2 trends. But that period included both antropogenic warming and likely some warming from natural variability. so it is not directly evidence that temperature effects will always outweigh co2. also, it did not directly estimate co2 effects but took them from previous studies. i suggest all these sentences be removed (starting from "In the next few decades") and just skip to the "Compared to the AR4..." i would also remove the last sentence in this paragraph and just refer to chapter 7 for evidence on price effects. (David Lobell, Stanford University)	We have removed this statement and much of the rest of the paragraph that it was a part of. We have, as the reviewer suggested, referred largely to the assessments on price effects made in WGII Chapter 7.
404	57765	19	20	32	20	32	isn't the Sahel in Sub-Sahara? (David Lobell, Stanford University)	This sentence has been removed.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
405	77732	19	20	37	20	40	This is presumably emissions scenario dependent - so that dependence should be made clear. Also, there is additional literature that can be evaluated here. The question that is being discussed deals with "emergence" (when will the range of natural climate variability on some defined time scale - daily, monthly, annual, etc) fall outside the range that is occupied by the current climate. A recent paper that deals with this is Hawkins and Sutton, GRL, doi:10.1029/2011GL050087. See also WG1, 11.3.2.1.2 and their Figure 11.14. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have removed much of this paragraph and instead refer to the assessments made on this material in WGII Chapter 7.
406	82989	19	20	37	20	40	It would be helpful to specify the relevant scenarios of climate change for this projection. (Katharine Mach, IPCC WGII TSU)	Please see comment 405.
407	77733	19	20	46	20	46	"have already been" gives the impression that weather induced yield loss is an emerging phenomenon related to climate change, but readers will no doubt point out that this is a phenomenon that is probably as old as agriculture itself. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you, this statement has been removed.
408	57767	19	20	46	22	25	I hate to sound territorial or critical, but this entire discussion has a lot of overlap with other chapters and has a lot of loose language without confidence statements. It talks about specific numbers from selected studies but there is no sense of how robust they are. most importantly, i'm not really sure what this section is trying to say. it meanders from climate impacts to not eating meat to yield gaps to biofuels. it seems the first paragraph of this section said all that was needed at least based on the title of the section (i.e. that the impacts discussed in chapter 7 will quickly move across boundaries and we have seen examples of that recently). (David Lobell, Stanford University)	Thank you. In service of reducing overlap with WGII Chapter 7, we have removed considerable portions of the material that appeared in 19.4.1 from the SOD. We instead include more cross-references to the assessments and confidence statements from WGII Chapter 7. In addition, we have included more targeted paragraphs and topics sentences to make the logical progression clearer.
409	82990	19	21	3	21	4	Is there a probabilistic basis for this likelihood term, or would a level of confidence be preferable? (Katharine Mach, IPCC WGII TSU)	We agree, we have revised this sentence with confidence langauge.
410	84375	19	21	3	21	4	The quantitative basis for the probabilistic "likely" here is not clear. This context may be better suited to a confidence assignment. (Michael Mastrandrea, IPCC WGII TSU)	Please see comment 409.
411	74191	19	21	6	21	9	What is the assessment here? This is not a literature review; rather it's pulling a single statement from one study. What are the key assumptions made by this report claiming that yield losses approach 30-50% by 2100 - even under a low emissions scenario. This statement does not even capture the potential for adaptation identified by the authors. (UNITED STATES OF AMERICA)	This statement and much of the paragraph it was contained within have been removed.
412	57808	19	21	6	21	19	The arguments in this paragraph seem very 1-sided. The caveats "these approaches are not necessarily better than eariler studies" leaves the reader in limbo. What is the assessment here? This should not be just a literature review. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Thank you. We have removed much of this paragraph as this topic is covered in WGII Chapter 7.
413	77734	19	21	8	21	11	What do the quoted uncertainty ranges represent - and is the chapter happy that they represent all relevant uncertainties that might affect projections of yield losses? (Francis Zwiers, Pacific Climate Impacts Consortium)	This material has been removed and this comment is therefore no longer relevant.
414	84376	19	21	14	21	14	Is this 4 deg C above preindustrial, or another reference point? (Michael Mastrandrea, IPCC WGII TSU)	Please see comment 413.
415	82991	19	21	15	21	15	It would be preferable to indicate more specifically what is meant by "falls back." (Katharine Mach, IPCC WGII TSU)	Please see comment 413.
416	84377	19	21	20	21	22	There is some overlap between these lines and lines 38-41 on the same page--consider merging the points. (Michael Mastrandrea, IPCC WGII TSU)	Thank you - in service of reducing overlap, the material related to indirect land use change has been consolidated and moved to 19.3.2.2.
417	82992	19	21	20	21	36	Table 19-1 could be cross-referenced here, with overlap reduced as much as possible. (Katharine Mach, IPCC WGII TSU)	Thank you. We have now included a cross-reference to the former Table 19-1 (now Table 19-2) and consolidated biofuels-related material with 19.3.2.2 to reduce overlap.
418	61482	19	21	38	21	41	This paragraph, particularly the first sentence, is unclear and is in need of supporting evidence and references (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Thank you. This material has been removed.
419	82993	19	21	38	21	41	Citations should be provided for these statements. (Katharine Mach, IPCC WGII TSU)	Please see comment 418.
420	77735	19	21	49	21	49	Avoid introducing acronyms that are used only rarely - they just make the text harder to read, while saving very little space. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you. This material has been removed from 19.4.1. However, in section 19.3.2.2. we maintain the usage of iLUC as the phrase is lengthy and used several times.

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421	62969	19	22	1	23	15	Some additional references on climate change and migration are: Oliver-Smith, A. (2009): Nature, Society, and Population Displacement. Toward and Understanding of Environmental Migration and Social Vulnerability. InterSecTions No. 8. United Nations University - Institute of Environment and Human Security (UNU-EHS). Bonn; Leighton, M. ; Shen, X. ; Warner, K. (2011) (Eds.): Climate Change and Migration: Rethinking Policies for Adaptation and Disaster Risk Reduction. SOURCE No. 15. UNU-EHS. Bonn; Disappearing States', Statelessness and the Boundaries of International Law by JANE MCADAM (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	This comment is misplaced from 19.4.2.1. However, while we appreciate the suggestion, WGII Chapter 12 is the place for a comprehensive review of the migration literature. Chapter 19's review is targeted at specific issues related to our evaluation of key vulnerabilities, key risks, and emergent risks.
422	79983	19	22	8	22	18	The message in these lines seems to be important; 70 % of the global agricultural area is used to produce feed/fodder for animal production. Even small changes to diets and meat consumption could have large impacts on the pressure on land use, grain price (NORWAY)	Thank you. While this material if of general importance, it is not directly relevant to an assessment of risks related to climate change, and was therefore removed.
423	82994	19	22	9	22	14	Is dairy still included across these examples? (Katharine Mach, IPCC WGII TSU)	See comment 422.
424	84378	19	22	19	22	21	"A growing call" by whom? Please include relevant citations here. (Michael Mastrandrea, IPCC WGII TSU)	This statement has been removed.
425	82995	19	22	36	0	0	Section 19.4.2.1. In finalizing this section, the chapter team should prioritize continued coordination with the key findings of chapter 12. (Katharine Mach, IPCC WGII TSU)	We have closely coordinated with Chapter 12.
426	61483	19	22	45	22	48	By "determined by a variety of metrics", do you mean the ways in which the consequences are measured, or the causal factors determining the form of the consequences? This statement could be clearer in this regard. Further on, it is claimed that projections of positive and negative outcomes are "not yet available". I'm not sure that such projections will ever be available (or even necessary), given the complexity with which we are dealing. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Section has been edited to address both points.
427	62970	19	22	46	22	47	Based on a protocol developed for Where the Rain Falls, field research was conducted in eight countries (Bangladesh, India, Guatemala, Peru, Ghana, Tanzania, Thailand and Vietnam) to examine the interplay among rainfall patterns, food security and human mobility. Using a Participatory Research Approach (PRA), household surveys and expert interviews–as well as local and global observation systems covering rainfall variability–the research aimed to answer this question: Under what circumstances do households use migration as a risk management strategy in response to increasing rainfall variability and food insecurity? For more information on individual case studies see: http://wheretherainfalls.org/overview/ (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	Such individual cases are best assessed in Chapter 12.
428	82996	19	22	46	22	50	Cross-references to chapter 12 would be preferably made at the level of specific chapter sections. (Katharine Mach, IPCC WGII TSU)	Section edited accordingly.
429	61484	19	23	4	23	6	Could some estimated numbers be mentioned here? McGranahan et al (2007) report that around 10% of the world's population live in the "Low Elevation Coastal Zone", <10m above sea level. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The point of this section is to emphasize that specific numbers for regional outcomes of various types are not available so the global number is of little help in providing context. The <10m area is far too large to be relevant to this sort of assessment.
430	60107	19	23	5	0	0	Add "yet" at the end of the line (AUSTRALIA)	Edit made.
431	77736	19	23	8	23	15	I think the chapter needs more summary paragraphs like this in which assessments are distilled (including assessments on the state of the literature) from the information presented in the text. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you for this advice.
432	82997	19	23	11	23	11	This cross-reference to chapter 8 would preferably indicate the specific relevant chapter sections. (Katharine Mach, IPCC WGII TSU)	Edit made.
433	82998	19	23	18	0	0	Section 19.4.2.2. In finalizing this section, the chapter team should prioritize continued coordination with key findings of chapter 12. (Katharine Mach, IPCC WGII TSU)	This section has been coordinated with authors in chapter 12
434	57647	19	23	18	24	7	19.4.2.2 hangs on Solomon Hsiang. Hsiang is junior with bachelor degrees in urban planning and earth sciences and PhD in sustainability. Why not hang this section on Nils-Petter Gleditsch, who has decades of experience in conflict research? Gleditsch reaches the opposite conclusion, by the way. This section is also in stark contrast to the much better informed discussion in Chapter 12 (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This comment is irrelevant.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
435	61485	19	23	18	24	7	The authors are clearly aware of the often controversial and overly deterministic nature of research into climate change and violence, given the wording used throughout the section. Violence and conflict is rightly described as an emerging risk, but it might also be useful to re-state its character as an emergent risk as defined by the complex interaction of different systems (e.g. food security, land-use, resource depletion and so on). The section discusses violence more in terms of measurable, linear causations, rather than emphasising the interaction of climate change with other sources and drivers and conflict. The section could benefit from a more nuanced treatment of the emergent character of such risks, rather than just emphasing the emergence of this research area in the literature. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	To keep the discussion concise, readers are referred to chapter 12 for a discussion of the complexity of mechanisms.
436	79083	19	23	18	24	7	This text has different core statements than Chapter 18.4.6.1. Please check with the other authors for onsistency. It may be advisable to reference the other sub-chapter and explicitly show differing points of view. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	This section has now been coordinated with authors in chapter 18.
437	60603	19	23	20	23	26	While it is true that a large number of studies have found effects of climatic events on violence, there is also a good number which have not. As written in chapter 12, (stll) past evidence is not conclusive. (Michael Brzoska, University of Hamburg)	Most studies that conclude "no effect of climate on conflict" arrive at this conclusion based on failing to obtain statistically significant associations. However, this conclusion does not follow logically from this finding. We now address this point directly with the text "While some individual studies have failed to obtain evidence that violence is associated with climate (Buhaug, 2010; Theisen et al. 2011), the absence of evidence does not imply evidence of no linkage."
438	60602	19	23	20	24	7	The section on conflict and insecurity flatly contradicts the parallel section 12.5. in chapter 5. While the dicussion in chapter 5 is balanced, the discussion here in chapter 19 is not. It "cherrypicks" from the evidence presented more comprehensively in chapter 12. A good part of the discussion is based on (at the time of wiritng unpubiished) studies co-authored by one of the contributing authors. (Michael Brzoska, University of Hamburg)	This section has now been coordinated with authors in chapter 12
439	57809	19	23	23	23	32	The long list of references is not helpful. Delete and reword the argument. What is the assessment? The IPCC is not a literature review. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The references cited has been shortened dramatically.
440	78244	19	23	23	23	32	To be more specific: A list of studies is listed here, but not relevant publications by Gleditsch and Buhaug (PRIO) on the climate-conflict link which should be included. The publication by Theisen (2012) is quoted but not in the reference list. There was a special issue of the Journal of Peace Research (2012) of which more could be included into the references. (Jürgen Scheffran, University of Hamburg)	The references cited has been shortened dramatically. The studies In the special issue of the JPR are reviewed and discussed in many of the review articles currently cited.
441	60108	19	23	23	23	33	Suggest rewriting after "... (Xsiang and Burke, 2012)...", so that the next (long) sentence reads: "Most empirical studies that have been released after AR4 (state the body of references) indicated the possibility that climate change ..." (AUSTRALIA)	The section has been rewritten, albeit somewhat differently from the suggestion.
442	63715	19	23	23	23	33	This sentence is not logical. The possibility that cc will alter patterns of violence was already an emerging risk before all these studies were published, but at the time of AR4 this fact was only not yet discovered. And of course it is good to have than one reference for important findings, but this reference list is a bit exaggerated. (GERMANY)	First, we no longer use the phrase "emerging risk." Second, previous to this assessment there was unsufficient literature to provide a plausible assessment. Finally, the list of references cited have been shortened dramatically.
443	78245	19	23	32	23	33	The following statement is contested in the literature: "a large literature provides systematic and consistent quantitative evidence that climatic events alter rates of modern violence". Chapter 12 as well published literature reviews have been more cautious (Bernauer et al. 2012, Scheffran et al. 2012, Theisen et al. 2013 in Climatic Change). This statement and the following two paragraphs rest on two references (Hsiang et al. 2012, 2013) which have been submitted but apparently not yet been published in peer-reviewed journals. (Jürgen Scheffran, University of Hamburg)	This section has now been coordinated with authors in chapter 12
444	57645	19	23	33	23	34	"high temperature exacerbates modern violence is the most consistent empirical finding" Not in the paper I've read. If you really want to make this statement, you should include a table with the number of studies that find a significant, positive effect (few), significant, negative effect (more), and no significant effect (most). (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This table and supporting analysis is found in the cited article: Hsiang, et al (Science, 2013).

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445	63716	19	23	34	23	34	What is "modern violence"? Please explain. (GERMANY)	This language has been removed
446	60109	19	23	34	23	36	The part of this sentence should be rewritten, so that it reads: "... having been reported at spatial scales ranking from the individual (refs), communal (refs), national (refs) to the global levels (ref)." (AUSTRALIA)	This suggestion has been implemented
447	57646	19	23	36	23	36	Dell et al. is not about conflict. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Dell et al (AEJ: Macro, 2012) presents novel results regarding civil conflict incidence and irregular leader exit at the country-by-year level.
448	62959	19	23	38	23	39	While evidence is currently being made between the link between climate change impact on violence and conflict, there is no mention of how climate change adaptation measures work under this context and how there are opportunities for change. For instance, Hamza and Corendea demonstrate that the conflicts over limited resources, political obstacles or economic stagnation that generally characterize the notion of fragile state might be mitigated by market-based innovations which could offer a way to head off the "worst-case scenarios" with impacts rippling all over the world. Kindly see the following to publications for more sources on this topic: Hamza, M.; Corendea, C. (2012): Climate Change and Fragile States: Rethinking Adaptation. SOURCE No. 16. United Nations University Institute for Environment and Human Security (UNU-EHS). Bonn. Other references can include: Smith, D. and Vivekananda, J (2009) Climate Change, Conflict and Fragility. Understanding the linkages, shaping effective response. International Alert, London;Buhaug, H.; Gleditsch, N.P. and Theisen, O.M. (2008) Social Dimensions of Climate Change. Implications of Climate Change for Armed Conflict. The Social Development Department, World Bank, Washington DC. (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	The reader is now directed to chapter 12 for a discussion of these possible changes
449	60604	19	23	40	23	41	There is not only a lack of knowledge about the exact pathways but also there overall importance for future incidences and levels of violence. The text ignores a good part of the literature whith predominantly see climate change as a minor factor in explaining conflict (at least so far). (Michael Brzoska, University of Hamburg)	A discussion of all the factors that influence conflict is beyond the scope of the IPCC and does not contradict the findings presented in this section.
450	77737	19	23	44	23	44	It might be better to use confidence language here since the "event" to which the likelihood (a probability) is being applied is not very specific, and thus hard to quantify. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have now coordinated with chapters 12 and 18 to implement confidence language.
451	82999	19	23	44	23	44	Would a level of confidence be more appropriate here? (Katharine Mach, IPCC WGII TSU)	We have now coordinated with chapters 12 and 18 to implement confidence language.
452	60605	19	23	47	23	48	This sentence is questionable. The available evidence, as correctly presented in section 12.5., does not support with more than limited evidence and low conficence that the influence of cliamte is large beyond some, usually already marginalized, regions. It is therefore speculation whether the effect of cliamte change on conflict and insecurity will become a key risk. Of course, there is the potential, however in view of the criteria for risks developed earlier in chapter 19, it is a very uncertain potential. (Michael Brzoska, University of Hamburg)	We have now coordinated with chapters 12 and 18 to implement confidence language. It is worth noting that prior studies reviewed in Hsiang et al (Science, 2013) cover all regions of the world and the meta-analysis results obtained in that study are highly statistically significant ($p<0.001$).
453	74192	19	23	48	23	51	Is the relationship between conflict and temperatures or rainfall a direct relationship or indirect relationship? For example, warmer temperatures and extreme rainfall leading to depletion of natural resources which in turn causes conflict? Can this relationship be applied to universally to all geographic areas around the world? (UNITED STATES OF AMERICA)	The relationship is probably indirect. As stated in the text, "Existing evidence suggests that climatic events contribute to the likelihood of violence through multiple pathways discussed in section 12.5 (Scheffran et al., 2012; Bernauer et al., 2012; Hsiang and Burke, 2013)."
454	60606	19	23	49	23	51	The numbers presented here are based on one (so far unpublished) study by one of the contributing authors. I hope that this does not meet the IPCC standards for evidence. Therefore the following sentence is not based on suffiecient evidence. (Michael Brzoska, University of Hamburg)	The numbers presented were published in Science (2013) after peer review. That article represents the sole meta-analysis of the literature, but spans 60 studies and 45 conflict data sets. The findings are drawn from the literature as a whole and are not the result of a single study.
455	57810	19	23	51	23	52	What RCP? The statement needs a likelihood or confidence assessment. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The study used the A1B scenarios from CMIP3
456	83000	19	23	51	23	52	Is this the projected outcome across scenarios of climate change? (Katharine Mach, IPCC WGII TSU)	The study used the A1B scenarios from CMIP3

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457	68184	19	24	0	26	0	Comparing the impacts of newly developing technologies at small scale to those technologies that are more advanced and are developed at large scale is unbalanced reporting. Once any technology is scaled up to the size needed for significant utility-scale generation, these other technologies will also face challenges with regard to land-use change and the associated impacts. (International Hydropower Association (IHA))	We have removed most of the text relating to hydropower.
458	77738	19	24	2	24	2	It might be better to use confidence language here since the "event" to which the likelihood (a probability) is being applied is not very specific, and thus hard to quantify. Also, links back to the evaluation of the supporting evidence should be provided (I think more is required than a single example from the literature). (Francis Zwiers, Pacific Climate Impacts Consortium)	We have now coordinated with chapters 12 and 18 to implement confidence language.
459	83001	19	24	2	24	2	Would a level of confidence be more appropriate here? (Katharine Mach, IPCC WGII TSU)	We have now coordinated with chapters 12 and 18 to implement confidence language.
460	63717	19	24	2	24	5	This sentence is extremely difficult to understand´, please rephrase. (GERMANY)	The text has been reworded.
461	60110	19	24	3	0	0	Suggest that Instead of "... their climate ..." use "... future climate ...". Then, use a full stop after "population" and start a new sentence. (AUSTRALIA)	This statement has been removed.
462	60607	19	24	4	24	5	In this case a very strong statement (that climate change will have a major influence on future conflit rates) is based on one study which has a different focus than is presented here. That study finds differing rates of conflict for ENSO and non.ENSO years, while here a prediction is made for larger rates of conflict with higher temperature without alternating cool periods. The study quoted here has no explanation for the empirical patterns found, so it can not be excluded that the higher conflict rates in ENSO years are partly a result of low conflict intensiies in the cooler years. It is premature to deduct, predictions of the effects of permament temperature changes from the study of the relationship of temperature and conflict in the ENSO cycle. (Michael Brzoska, University of Hamburg)	This statement has been removed.
463	83002	19	24	10	0	0	Section 19.4.2.3. The chapter team should coordinate material here with the key findings of chapters 4, 6, and 30, especially. (Katharine Mach, IPCC WGII TSU)	Text cross-referenced and modified to be consistent with increased detail in other chapters.
464	77739	19	24	13	24	14	This sounds to me like it should be couched in appropriate calibrated assessment language. (Francis Zwiers, Pacific Climate Impacts Consortium)	This language has been modified.
465	57811	19	24	15	24	20	Since the forests regrow fairly quickly, the net carbon flux may be near zero or of either sign on decadal and longer time scales. What is the time scale in view for this paragraph? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have shortened this section and removed the relevant text.
466	71407	19	24	18	24	19	Timber harvest has increased, not declined due to MPB. Please check the end of the sentence, which says "especially from forest fires"- how is this related to the statement? Were these fires resulting from MPB damage? Also, there's no reference for this part of the sentence - suggest adding citation(s) if possible. Finally, Kurtz et al. (2008) is not in the reference list. (CANADA)	We removed the relevant text owing to space constraints.
467	80558	19	24	46	26	15	The content of Section 19.4.3 does not appear to be mentioned in the Exec Summary, but it should be as it contains very important information. (Richard Betts, Met Office Hadley Centre)	Thank you, section 19.4.3 is now reflected in the Executive Summary
468	84379	19	25	1	0	0	Section 19.4.3.1: Consider the discussion of similar topics in sections 19.3.2.2 and 19.4.1, as well as ways to reduce overlap. (Michael Mastrandrea, IPCC WGII TSU)	We modified this section to remove the overlap with 19.3.2.2. and 19.4.1.
469	79084	19	25	1	25	37	This sub-chapter needs amandments to be balanced. Hydropower and the consequences of dam construction take too much place compared to the other aspects, and e.g. changes in landmanagement are only mentioned in passing-by, although intensification of forest mangement or agricultural practices is a well-known driver of biodiversity losses. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	This section has been modified for balance and the text on hydropower has been reduced substantially, with cross references to pertinent sections in other WGII chapters.
470	63718	19	25	8	25	9	It is not that easy - increased agricultural productivity may also make agriculture more profitable and thus would even increase competition for land. Please check Ewers et al. (2009) in Global Change Biology 15, pp. 1716-1726; Rudel et al. (2009) in PNAS 106, pp. 20675-20680. (GERMANY)	The content on interactions between bioenergy production and land use has been shortened in this section - this content now largely appears in 19.3.2.2. This particular sentence was deleted, but the remaining content has been modified for balance and cross-references other pertinent WGII chapters.
471	60111	19	25	14	25	37	Section provides examples of projects using conservation offsets. An overarching statement pointing out the benefits of biodiversity offsets and markets more broadly would add to this section (avoid, reduce, offset). This might also point to existing (non-renewable) developments that participate in biodiversity markets where ecological imapcts are unavoidable. (AUSTRALIA)	Much of the text has been reduced and cross-referenced to other chapters where it is treated in more detail

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472	62960	19	25	17	25	29	References are taken from year 2006 and 2000. It might be more relevant to cite more recent literature and not those that repeat what had been said in the 4th Assessment Report. (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	This text has been substantially modified for balance and now largely cross-references content in other pertinent WGII chapters.
473	60112	19	25	19	25	19	Statement relating to "siting and monitoring can decrease potentially large-scale negative ecological and socio-economic impacts [of renewable energy projects]" overstates risk of impacts. Suggest dropping"large-scale" from the statement. (AUSTRALIA)	Done
474	68182	19	25	23	25	33	These sentences represent very outdated thinking, significant work has taken place on the topic of sustainable hydropower development. Furthermore, the section is scientifcally unbalanced and amounts to gross generalization. It also ignores the fact that water storage is required for most energy technologies. In particular, the statement from line 31 requires much further interrogation and a balanced approach based on current facts. (International Hydropower Association (IHA))	Much of the text on hydropower has been removed. The remaining text has been modifed and cross-references pertinent sections from other WGII chapters.
475	68181	19	25	31	25	37	The statement "biodiversity losses of large dams particularly relative to the benefits of the dams……tends to be very high" - this is a value judgment and is not an accurate statement. The metric given, total inundated land area per unit of electricity produced, is only one "benefit". Most storage hydropower reservoirs around the world serve multiple purpose - electricity provision is only one of the benefits, and is often considered low among the priorities for the use of the water stored. (International Hydropower Association (IHA))	Much of the text on hydropower has been removed. The remaining text has been modifed and cross-references pertinent sections from other WGII chapters.
476	68183	19	25	33	19	36	These lines should be completely removed from the document because they do not in any reference biodiversity, and the topic of the section is biodiversity. They are completely out of context and are inappropriate. (International Hydropower Association (IHA))	Done
477	61486	19	25	35	0	0	Could usefully clarify which jurisdiction this renewable fuel standard applies in. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We are unclear what this comment is referring to, perhaps it has been misplaced.
478	77740	19	25	46	25	46	Avoid introducing acronyms that are used only rarely - they just make the text harder to read, while saving very little space. (Francis Zwiers, Pacific Climate Impacts Consortium)	Done
479	80593	19	25	52	25	53	"led to dense monoculture stands of fast growing tree species through the Three North Shelterbelt Development Program","of fast growing tree species" is advised to be removed which be only a small proportion of afforestation area. (chaozong xia, academy of forest inventory and planning)	Done
480	60113	19	26	2	26	3	"Relocation of human populations from agricultural lands in order to reforest would have negative consequences"- replace "would" with "may", unless this general statement can be supported by a reference. (AUSTRALIA)	Text removed
481	77741	19	26	5	26	5	How would the overall benefit be determined and would you maintain this view under a range of different development and mitigation policy scenarios? For example, would you maintain this view if carbon emissions had a high price (in which case, I could imagine there might be a case for replacing forests that sequester carbon slowly with others that do so more quickly ...). (Francis Zwiers, Pacific Climate Impacts Consortium)	Text removed
482	61487	19	26	15	0	0	19.5.1. The heading of this section 'a large temperature rise' is not very informative. Perhaps better to say rises beyond the 2C threshold. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have now specified the large temperature rise: it is above 4C relative to pre-industrial times
483	67890	19	26	17	0	0	Section 19.5: Please discuss the climate change risk by taking into account the climate change rate as discussed in Chapter 4 (4.3). Climate change rate is an important factor to discuss climate impacts, climate change risk and a rate of adaptation of socially and biologically. Concerning to climate change and its risk, equilibrium would be reached only after centuries to millennia as written in WG1 AR5 SOD. On the other hand, the life time of the concrete structure is several ten years, which is much shorter range of the above gradual change. (JAPAN)	We do not treat risks from rate of climate change as a separate type of risk but rather integrate it into the risks discussed in this section. We have made sure to highlight rate of change risks where relevant, for example in the risk associated with rapidly terminating geoengineering and risks to ecosystems associated with large temperature rise.
484	80748	19	26	22	0	0	Box CC-OA identifies ocean acidification as an issue distinct to climate change, with the same cause generating both. Hence, for consistency, this sentence should be revised to reflect that. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	We understand the perspective of the reviewer but have decided to retain the current text in order to indicate that ocean acidification is an issue that is an aspect of climate change in all plausible future scenarios.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
485	83003	19	26	27	0	0	Section 19.5.1. Given the importance of this section for the summary products of the report, the chapter team is encouraged to ensure clear key findings, with calibrated uncertainty language, are presented within the section, with thorough cross-referencing to other relevant sections of other chapters where appropriate. For risks discussed, it would be great if further indication could be provided regarding the extent to which risks can be reduced through adaptation. (Katharine Mach, IPCC WGII TSU)	This section has been revised with great attention to key findings and uncertainty language and careful cross referencing to other relevant sections.
486	84382	19	26	27	0	0	Section 19.5.1: Currently, the section contains much useful information, but reads as a dense listing of examples. It would be very useful to consider ways to make use of the existing Table 19-2, possibly considering organization by sector/region as employed in tables such as SPM.1 and SPM.4. With more details presented in tabular form, the text could then focus more on discussion of synthesis across the specific examples. It would also be very useful to continue efforts to coordinate this material with other chapters. (Michael Mastrandrea, IPCC WGII TSU)	We coordinated carefully with other chapters, and considered inserting an additional table, but we finally decided against doing that as it wouldn't have saved much space and the discussion would have been in two places - the text and table.
487	74193	19	26	27	26	27	Can a level of confidence be provided in this section, regarding the likelihood of a > 4 C increase in global temperature? (UNITED STATES OF AMERICA)	Providing confidence on whether we might reach a 4C warming is not in the remit of WGII of this assessment.
488	71408	19	26	27	30	48	Discussion of risk could include some consideration of probability - why is this aspect not discussed in these examples? From the explanations/definitions earlier in the chapter, most of these examples read more like emerging 'vulnerabilities' (CANADA)	We have rewritten the section extensively
489	62595	19	26	29	26	37	To provide context and relevance to AR5, it is important ot mention here for which emission scenario (RCP6.0 or RCP8.5) a warming of greater than 4 deg C is projected by CMIP5 models. (INDIA)	We have detailed information about the relationship between large temperature rise and the RCP scenarios as requested.
490	62968	19	26	29	27	53	While more emphasis is given to Impacts of +4°C: It should also be noted that warming above +4°/+5°C could result in serious consequences. See:Stern Review 2007; Warner, K.; Kreft, S.; Zissener, M. et al. (2012): Insurance Solutions in the Context of Climate Change-Related Loss and Damage. Policy Brief Series No. 6. United Nations University Institute for Environment and Human Security (UNU-EHS). Bonn. (Kristina Yuzva, United Nations University Institute for Environment and Human Security (UNU-EHS))	The section is entitled risks of large temperature rise of greater than 4C above pre-industrial: indicating that we already appreciate this point and the next text as far as possible encompasses risks beyond 4C rise, but due to the limitations of literature much of the focus remains on 4C
491	69872	19	26	34	26	35	The Betts et al. (2011) and Sanderson et al. (2011) references do not appear to be listed in the reference section. (John Caesar, Met Office Hadley Centre)	Thank you for pointing this out - the in-text citations have been carefully checked and the bibliography has been completed for the FGD.
492	57812	19	26	35	0	0	a 4C world - A word is needed before "world". "Warmer" would work. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have reworded such instances in the text.
493	62721	19	26	35	26	37	Arnell et al. (2009) could not be found in the reference list and not be checked. Hayashi A., Akimoto, K., Tomoda, T., Kii, M., Global evaluation of the effects of agriculture and water management adaptations on the water-stressed population, Mitigation and Adaptation Strategies for Global Change, DOI 10.1007/s11027-012-9377-3 shows that the dominant factor is not temperature rise but is population even in the case of 3.7 degrees C relative to 1990 level (baseline scenario; about 4.3 degrees C relative to preindustrial level). The following sentence should be added. "However, even in a 4 ºC world, there are also a literature indicates that the effects of population increases are dominant over those of climate change (Hayashi et al 2013)." (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	This sentence has been deleted, including the citation mentioned.
494	67891	19	26	35	26	37	The reference by Arndell et.al. cannot be found. Please cite the following literature instead: Hayashi A., Akimoto, K., Tomoda, T., Kii, M., Global evaluation of the effects of agriculture and water management adaptations on the water-stressed population, Mitigation and Adaptation Strategies for Global Change, DOI 10.1007/s11027-012-9377-3, in which "water stress " was treated with a baseline (+3.7 degree C at 2100 (base year: 1990)) and Medium estimation of population (UN 2009). In this paper, it is positive that population increase have more obvious effects than climate change. Therefore, after the sentence, please put the following description "However, even in a 4 degrees Celsius world, there is also literature indicating that the effects of population increases are dominant over those of climate change (Hayashi et al 2013)." (JAPAN)	This sentence has been deleted, including the citation mentioned.
495	80559	19	26	35	26	37	Caution is needed here - the HadGEM2-ES and HadCM3 climate models suggest that climate change may lead to a net global reduction in runoff (despite increasing it in some regions), and that rising population may therefore remain the dominant driver of water stress (Wiltshire et al, 2013, Sustainability; Betts et al, 2013, submitted to Biogeosciences Discussions). (Richard Betts, Met Office Hadley Centre)	We have reworded the text of this section to reflect the literature that accounts for wetting in some regions and drying in others.
496	57813	19	26	39	26	45	Several likelihood statements are missing here. What is the basis for the ranges given? 1 standard deviation or what? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This paragraph has been substantially rewritten.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
497	62596	19	26	39	26	45	It is shown by climate modesl that wet regions become wetter and dry regions become drier under climate warming. This would mean water availability would increase in the tropical region and midlatitude regions and decrease only in subtropical regions. Some discussions on the regional disparties is important here. (INDIA)	We agree, we have revised the text now to do so.
498	80560	19	26	40	26	43	Contrast with results by Wiltshire et al (2013, Sustainability) and Betts et al (2013, submitted to Biogeosciences Discussions) in which the HadCM3 and HadGEM2-ES climate models suggests a trend towards a wetter rather than drier world. (Richard Betts, Met Office Hadley Centre)	This section has been completely rewritten to include literature that encompasses wetting as well as drying, however space for this section was at a premium so we were not able to include the specific citations you suggested.
499	83004	19	26	41	26	43	Given comments on this example during the development of the SPM draft, the chapter team should ensure the example is coordinated with assessment in chapter 25. (Katharine Mach, IPCC WGII TSU)	This section has been completely revised and new examples are now used
500	74194	19	26	43	26	43	One of the critical aspects of increasing temperature is the timing of spring flows in the river systems where snow/glacier melt contribution to spring season. Shifts in the timing of snow/glacial melt flows will have impact on many systems both human and ecological. What will be the changes in the seasonal floods due to temperature rises on the river system depending on snowmelt such as Ganges? (UNITED STATES OF AMERICA)	We recognize that this effect is important and it is discussed in section 19.6.3.2.. The literature on this does not directly address large temperature rise.
501	83005	19	26	43	26	43	How is drought disaster affected area defined? (Katharine Mach, IPCC WGII TSU)	We have defined this in section 19.5.1
502	84383	19	26	43	26	45	It is not clear what these percentages mean (of what?). In addition, the definition of drought disaster affected area is not clear. (Michael Mastrandrea, IPCC WGII TSU)	The index refers to the proportion of major cropland growing areas where the 3 month PDSI is less than -3 in the growing season. This now explained in the text.
503	80561	19	26	47	26	48	A more specific citation is needed than just "IPCC AR4" - which chapter? Is there more recent literature to back this up, or indeed any which counters it? Simply recycling AR4 is weak. (Richard Betts, Met Office Hadley Centre)	Now that the latest text of IPCC AR5 Ch 7 is available, this section has been revised to reflect their findings relating to temperature rise above 4C.
504	60114	19	26	47	26	49	First sentence is difficult to decipher. Does this comment refer to a reduction of agricultural production in mid-latitutdes between 3-4 degrees or is the statement applicable for all temps >3 degrees (as per following sentence in the section)? (AUSTRALIA)	Please see comment 503.
505	83006	19	26	47	26	53	The chapter team should ensure this material is coordinated with Chapter 7 key findings. (Katharine Mach, IPCC WGII TSU)	Please see comment 503.
506	74195	19	26	47	26	54	What are the impacts on temperature rises on pests such as locust, army worms etc? How will the increase/decrease in pest population affect agriculture? How does decrease in cold days/nights affect pest population or multiplication characteristics? (UNITED STATES OF AMERICA)	Impacts on agricultural pests are covered in section 19.3.2.1, cross referencing Ch 7. We did not find literature covering climate change impacts on agricultural pests at the large temperature rises of 4C or more that are the subject of this section.
507	80563	19	26	47	26	54	Also mention the beneficial effects of CO2 rise and the limitation of the extent to which these have been studied (eg: FACE experiments tend to be 600ppm or below, so there is less known about higher levels of CO2 that would probably accompany 4 degrees C) (Richard Betts, Met Office Hadley Centre)	Please see comment 503.
508	57814	19	26	48	0	0	and for lower temperature rise in the tropics - Hangs. More is needed here or delete. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Please see comment 503.
509	57815	19	26	49	0	0	Beyond 4C … - Words are needed are 4C. "Global warming" would work. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Please see comment 503.
510	77742	19	26	52	26	52	Is 63-82% credible? I think the chapter would be expected to provide a critical assessment of this kind of result. (Francis Zwiers, Pacific Climate Impacts Consortium)	The sentence has been removed and the agriculture-related material in 19.5.1 has been condensed considerably, and provides additional cross-references to Chapter 7.
511	80562	19	26	52	26	52	Note that the Schlenker and Roberts (2009) was only for the USA. (Richard Betts, Met Office Hadley Centre)	See comment 510.
512	57816	19	26	53	0	0	4C warming - Change to 4C global warming. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This sentence has been removed.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
513	74196	19	26	53	26	54	Does the crop model include changes in evapotranspiration changes due to temperature increases? (UNITED STATES OF AMERICA)	Chapter 7 authors have advised that some crop models include effects of potential evapotranspiration. However, this statement has been removed.
514	67892	19	27	0	0	0	The decrease of pH should be utilized instead of rise in ocean acidity. Because pH is much more common expression for water acidity. (JAPAN)	The statements have been replaced with links to projections of ocean acidification from AR5 WGI.
515	57817	19	27	2	0	0	4C warming - Change to 4C global warming. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This sentence has been removed.
516	84384	19	27	2	27	3	Right now, this sentence could be read as implying that polar and tropical regions are affected under 2C warming but not under 4C warming, which I do not think is meant. (Michael Mastrandrea, IPCC WGII TSU)	The sentence has been deleted and the respective paragraph has been substantially revised.
517	57818	19	27	2	27	16	Likelihood or confidence assessments are needed throughout paragraph. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The chapter has made a significant effort to add confidence statements where possible.
518	61488	19	27	2	27	20	This paragraph seemingly represents the first use of confidence statements coupled with statements of evidential strength (e.g. "medium evidence, high confidence"). Are these statements to be used throughout the chapter? They are useful, and should be consistently applied where possible. This section would also benefit from more information on fire regimes. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	In revising this chapter we paid a lot of attention to consistent and additional use of confidence statements where possible. We have also revised the text concerning projected fire impacts in response to colleagues in Ch 4.
519	80566	19	27	4	27	4	This is not a true reflection of the conclusions of Zelazoski et al (2011). The paper suggests that under one of the CMIP3 models, the current area of potential climatological niche for Humid Tropical Forests in South America is reduced by about 80% under 4 degrees global warming - but this was only one model, and only in South America, and with one particular assumption about changes in ecosystem water demand. With other GCMs, regions and assumptions there was less dieback or even expansion of the HTF niche. This sentence needs to be re-worded to better reflect the paper, expecially the uncertainties and regional differences, and should also consider other papers. (Richard Betts, Met Office Hadley Centre)	This section has been rewritten and the sentence including the reference to Zelazowski has been removed.
520	69873	19	27	5	27	7	How precisely is a novel climate defined in this case? Based upon multi-variate metrics? Do the percentages include ocean areas? If it is based on no-analog climates, over what period are analogs assessed for? This section could do with additional clarification, including the implications of the percentage changes which are open to a variety of interpretations currently. (John Caesar, Met Office Hadley Centre)	This section has been rewritten and the reference to 'novel climates' and the Williams et al. study has been removed.
521	57819	19	27	6	0	0	novel climate - Define novel climate in some way. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	See comment 520.
522	74197	19	27	6	27	6	It is unclear what is meant by a "novel" climate. (UNITED STATES OF AMERICA)	See comment 520.
523	62597	19	27	9	0	0	"projected" -> "are projected" (INDIA)	This sentence has been rewritten such that this comment is no longer relevant.
524	57820	19	27	10	0	0	temperature anomalies - "anomalies" is missing. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	See comment 523.
525	69874	19	27	12	27	13	Would be useful to include some references to support the fire statement. (John Caesar, Met Office Hadley Centre)	This sentence has been deleted.
526	69875	19	27	13	27	14	Are there additional references which could be included to support the acidification statement? (John Caesar, Met Office Hadley Centre)	The citation to grey literature has been replaced with a cross reference to AR5 WGI. Additional text cross referencing AR5 WGII Chapters 5 and 26, CC-CR, and CC-OA have also been included.
527	77743	19	27	13	27	14	I'm not an expert in this area, but this seems off the mark. Coral bleaching is a serious issue that is linked to ocean temperatures in the current climate (see WG2 AR5 Ch 18), with concern that the phenomenon will only worsen as temperatures warm further. My naive sense is that ocean acidification would be a secondary concern. Also, it seems odd to me to be citing a World Bank report in this context; isn't there lots of peer reviewed literature? (Francis Zwiers, Pacific Climate Impacts Consortium)	See comment 526.
528	80749	19	27	13	27	14	I am not sure that a grey literature report is the best citation here. This issue is addressed in several chapters of the WGII report (5, 6 and 30) as well as in the cross chapter box CC-OA. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	See comment 526.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
529	83007	19	27	14	27	14	The described increase in ocean acidity is since preindustrial? (Katharine Mach, IPCC WGII TSU)	The revised discussion regarding ocean acidity is relative to preindustrial levels, which is now specified in the text.
530	57821	19	27	15	0	0	Hypoxic zone may be seen - They all ready exist - Reword. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We removed the text relating to hypoxic zones owing to space constraints.
531	83008	19	27	15	27	15	Since hypoxic zones are already observed and are natural phenomena to some degree, wording could be adjusted here. The description of impacts on coral reefs ("start to dissolve") could perhaps acknowledge further some of the complexity of the mechanisms of impact. (Katharine Mach, IPCC WGII TSU)	We agree but we had to remove the text on hypoxic zones from this section due to space constraints. We did not consider it a priority to retain this text because AR5 WGI does not provide evidence allowing us to make a statement about (for example) projection of extensive hypoxic zones under large temperature rise.
532	84385	19	27	17	27	18	Here and on line 49 of the same page, evidence and confidence assignments are presented together. In general, it would be preferable to present confidence on its own or with explicit mention of its basis in evaluation of both evidence and agreement. In other words either "high confidence" in these cases, or "high confidence based on X agreement, X evidence" if necessary. (Michael Mastrandrea, IPCC WGII TSU)	We have revised the confidence statements as requested.
533	63719	19	27	18	27	20	This we know already, no need to repeat it. (GERMANY)	This sentence has been removed and we now cross reference the earlier statement.
534	57822	19	27	22	0	0	250,000 people - This needs some context. What fractional increase is this value? Does it only reflect more population and no/little climate change? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The figure assumes no population growth, as we already stated. We have replaced the statement with a new one reflecting the range of people that could be additionally affected over a given temperature range. Information about the impacts in the reference period has been added as requested. Figures are not available for other regions, as far as we have found, because few studies have analysed the effects of scenarios with large global temperature rise.
535	80567	19	27	22	27	22	Is there an uncertainty estimate for the figure of 250,000? (Richard Betts, Met Office Hadley Centre)	The figure assumes no population growth, as we already stated. We have replaced the statement with a new one reflecting the range of people that could be additionally affected over a given temperature range. Information about the impacts in the reference period has been added as requested. Figures are not available for other regions, as far as we have found, because few studies have analysed the effects of scenarios with large global temperature rise.
536	74198	19	27	22	27	23	How does the number of people that are projected to be affected by river flooding in Euorpe compare to current number of people affected? What is the increase in terms of percentange? (UNITED STATES OF AMERICA)	The figure assumes no population growth, as we already stated. We have replaced the statement with a new one reflecting the range of people that could be additionally affected over a given temperature range. Information about the impacts in the reference period has been added as requested. Figures are not available for other regions, as far as we have found, because few studies have analysed the effects of scenarios with large global temperature rise.
537	61489	19	27	22	27	24	This paragraph could be expanded - are figures available on the impacts of river flooding at these temperatures in other regions? For the European figures, it is not clear what the "additional" figure is in relation to. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The figure assumes no population growth, as we already stated. We have replaced the statement with a new one reflecting the range of people that could be additionally affected over a given temperature range. Information about the impacts in the reference period has been added as requested. Figures are not available for other regions, as far as we have found, because few studies have analysed the effects of scenarios with large global temperature rise.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
538	80418	19	27	22	27	24	Please provide correct references to the WGI AR5 contribution, e.g., the reference to WGI Ch13 Table 13.5 does not support the inaccurate statement of 0.5-1.0m SLR for 4°C warming. Which scenario provides the basis for this statement, RCP8.5? Please revise and check consistency with WGI Ch13. Regarding the entire section, the whole discussion of exceeding temperature targets has to be linked to the WGI assessment. (Gian-Kasper Plattner, IPCC WGI TSU)	Section 19.5.1. has been revised considerably and this sentence has now been deleted. We believe all our numbers are now consistent with WGI's final version.
539	57823	19	27	23	0	0	"in RCP8.5" is missing from this sentence. SLR being assessed lower in the other RCPs should also be mentioned. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Section 19.5.1. has been revised considerably and this sentence has now been deleted.
540	76779	19	27	26	27	30	Would the loss of 5 percent in economic output be local or global? (Nicolas Desramaut, BRGM)	Section 19.5.1. has been revised considerably and this sentence has now been deleted.
541	78897	19	27	26	27	30	Have a look at Figure 25-5 and consider whether this is worthwhile referencing here. Note we don't have material on human impacts associated with that figure (no wet globe bulb temperature data), but the general evidence about increases in the number of days above 40 deg C in Australia would underpin this general area of concern. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	Thank you for this helpful suggestion, however due to space constraints we were unable to include this material.
542	83009	19	27	26	27	30	The chapter team should ensure statements in Chapter 11 are consistent with this text. (Katharine Mach, IPCC WGII TSU)	We have cross referenced Ch 11 as requested and ensured consistency.
543	61490	19	27	27	27	27	"human physiological limits" could use some elucidation - e.g. what are they, how are they calculated, what are the consequences of exceedance? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	There is not room to include this information here, please see Ch 11 for further details
544	69447	19	27	27	27	28	Sherwood and Huber, 2011 - missing reference (NETHERLANDS)	Reference has been added to the bibliography.
545	69876	19	27	29	27	30	Although it appears that the Russian case study is being used here simply to illustrate a general point regarding projections, it should be noted that there has been a degree of controversy regarding the attribution of the 2010 Russian heatwave which is summarised in Otto, F. E. L., N. Massey, G. J. vanOldenborgh, R. G. Jones, and M. R. Allen (2012), Reconciling two approaches to attribution of the 2010 Russian heat wave, Geophys. Res. Lett., 39, L04702, doi:10.1029/2011GL050422. Perhaps additional references or case studies could be cited here to support this point? (John Caesar, Met Office Hadley Centre)	We have removed the Russian case study and replaced it with the cross reference to chapter 11 and a cross reference to AR5 WGI.
546	77744	19	27	32	27	32	The use of wording "would be expected to be triggered" conveys a level of certainty that seems to override some of the uncertainty assessments that accompany the individual items. A more neutral way to introduce the list would be to say something like: "Several possible non-linear earth system responses have been assessed under a scenario with a persistent 4C temperarure rise. These include (a)...." (Francis Zwiers, Pacific Climate Impacts Consortium)	This text has been consolidated with 19.6.3.6 and no longer appears here. In 19.6.3.6 it has been reworded for consistency with AR5 WGI projections.
547	80564	19	27	32	27	33	Amazon die-back is not "expected" to be triggered for 4 degrees warming. While it cannot be ruled out, more recent studies suggest that it is a more uncertain and complex picture than thought in AR4 - eg: Good et al, 2013; Betts et al, 2013, submitted to Biogeosciences Discussions). And even the AR4 generation of GCMs (CMIP3) only included one model for which the eastern Amazon was projected to enter a climatic state which could not support rainforest (Betts et al, 2012, in Cornell et al (eds) - I can supply to TSU). Cross-check with Chapter 4 for further information. (Richard Betts, Met Office Hadley Centre)	We agree, also this text has been consolidated with 19.6.3.6 and reworded for consistency with AR5 WGI projections.
548	57824	19	27	34	0	0	Eventual irreversible loss - Needs a time scale. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This paragraph has been revised considerably and this sentence has been removed. Timescales for ice sheet loss discussed in 19.6.3.6.
549	57825	19	27	34	27	35	Most models and most RCPs keep the land a net carbon sink to 2100. This needs stated. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The text on carbon sinks has been removed.
550	80419	19	27	35	27	35	It is not clear what the reference to "AR5 WGI Ch. P.6-5“ means. Please clarify. (Gian-Kasper Plattner, IPCC WGI TSU)	This paragraph has been substantially revised and WGI cross references have been updated.
551	62598	19	27	35	27	37	Will this large warming lead to methane release from Arctic sea floor and hence catastrophic climate change? (INDIA)	We have added a sentence to explain the important issue of these feedbacks in the earth system, which previously were confined to section 19.6.3.6
552	67893	19	27	36	27	36	Please indicate how much of a possibility there will be regarding the breakage of WAIS after the increase. (JAPAN)	The discussion of the West Antarctic Ice Sheet has been removed from this section. See also 19.6.3.6.
553	57826	19	27	36	27	37	The chance is … greatly increased. - How much? Time scale? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This text has been consolidated with 19.6.3.6. and no longer appears here. In 19.6.3.6. it has been reworded for consistency with AR5 WGI projections.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
554	61491	19	27	42	27	45	This sentence needs editting. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This sentence has been removed.
555	83010	19	27	49	27	49	It would be preferable to also provide a summary term for agreement here. (Katharine Mach, IPCC WGII TSU)	A summary term for agreement has been added
556	80568	19	27	50	27	50	Although some studies project increased water stress at higher levels of global warming, some project a decrease (Wiltshire et al, 2013, Sustainability). (Richard Betts, Met Office Hadley Centre)	The sentence has been edited to reflect the geographical variation in projected change in water stress
557	57827	19	27	52	0	0	large aggregate - How large is large? 1% increase? 10? 100? 1000? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This text has been removed as this paragraph was largely rewritten. Section 19.6.3.5 provides details on mangitudes of loss.
558	61492	19	28	4	28	4	Table 19-2 This table is obviously a work in progress, but could the authors be sure to define what "climate space" means? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Table has been deleted due to lack of space
559	83011	19	28	8	0	0	Section 19.5.2. The chapter team should continue to coordinate this section with the key findings of chapter 6 and 30, with more explicit reference to the cross-chapter box on ocean acidification. (Katharine Mach, IPCC WGII TSU)	References to the appropriate specific sections in other chapters and cross-chapter boxes have been added.
560	80750	19	28	8	29	19	The cross chapter box CC-OA and its figure should be mentioned here and consistency checked. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	References to the appropriate specific sections in other chapters and cross-chapter boxes have been added, and consistency has been checked.
561	64555	19	28	11	28	11	19.5.2. here you could give the exact details for the citaion Box 3.2.: Ocean Acidification (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	A specific reference to the Ocean Acidificaiton box has been added.
562	57828	19	28	12	0	0	CO2 emissions that poses emerging risks to marine ecosystems - Temperature and Salinity changes also pose risk to marine ecosystems. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Agreed that salinity and temperature also pose risks to marine ecosystems, but given that this section explicitly applies to the risks posed by acidification, and given the space constraints, we have chosen not to address these two additional stressors, as they are addressed elsewhere in the report, particularly in Ch. 6.
563	77745	19	28	12	28	12	I would think of storm damage or coastal erosion as examples of physical impacts. Ocean pH change is probably better characterized as a biogeochemical impact of CO2 emissions. Chemical, physical and biological processes are involved in mixing CO2 into the ocean, and terrestrial biogeochemistry plays a role by sequestering carbon in the terrestrial biosphere and land surface, thus mediating the amount of emitted CO2 that is available to be taken up by the ocean. (Francis Zwiers, Pacific Climate Impacts Consortium)	Agreed, the sentence has been modified to describe ocean acidifiation as both a physical and biogeochemical impact. The term 'physical' was retained to reflect the fact that rising CO2 in the atmosphere, the root cause, is originally addressed in WG1 as part of the physics of climate change.
564	64556	19	28	21	28	21	19.5.2. the different shades of red are not well resolved, at least not in the pdf. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	The figure has been amended with better separation of colors.
565	77746	19	28	26	28	28	I like the figure and its use of colour, but I think there should be detailed links in the caption pointing to the evaluation of the evidence supporting the assessments presented in the figure. (Francis Zwiers, Pacific Climate Impacts Consortium)	The figure has been amended to reflect the specific sources of information on which it is based.
566	64557	19	28	27	28	27	The respective sections mention OA in chapter 6 should be specified: 6.?.?., 6.?.?... (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	References to specific sections of Ch 6 have been added.
567	61493	19	28	28	0	0	19.5.4. References in this section seem surprisingly old. Are there really no more up-to-date references, e.g. from the GeoMIP project or IMPLICC project, or EC funded research projects? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	It appears that the page number is incorrect for this comment and that it actually refers to section 19.5.4 (on geoengineering) rather than to ocean acidification which is the topic on p. 28. Regarding 19.5.4, a number of new references have been added, including all those available from GeoMIP that were accepted before the IPCC WG2 deadline.
568	77747	19	28	31	28	35	I think there should be detailed links pointing to the traceable accounts that support these assessments. Pointing just to the chapter is not sufficient. (Francis Zwiers, Pacific Climate Impacts Consortium)	References have been more explicitly linked to specific appropriate sections.
569	83012	19	28	31	28	35	It would be preferable to provide specific reference to the relevant sections of chapter 6. (Katharine Mach, IPCC WGII TSU)	References have been more explicitly linked to specific appropriate sections.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
570	57829	19	28	35	0	0	low to high confidence - Type-o? What does this mean if not a type-o? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This section has been rewritten, and the sentence referred to has been removed.
571	74199	19	28	39	28	53	This text, by implication, focuses on warmwater corals and ignores coldwater corals. Coldwater corals should be mentioned because north Atlantic species currently inhabit saturated water whereas north Pacific species often inhabit undersaturated (corrosive) water. (UNITED STATES OF AMERICA)	The reviewer is correct that the text focuses implicitly on warm-water corals. Given space constraints, it was not possible to treat both warm- and cold-water corals separately; a primary differences is that there is substantially less literature and greater uncertainty for cold-water corals.
572	57648	19	28	42	28	24	You omit that Narita et al. find a miniscule impact. You omit Brander et al. (Cl Ch Econ) on coral reefs. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Narita et al. 2012 do conclude that the impact of ocean acidification on mollusk fisheries alone would have a fairly small (1-1.5%) effect on total expected damages due to the climate change effect on GLOBAL GDP. The authors acknowledge that the regional impacts on various economies could be large, and that because this is a mollusk-only assessment, the expected impacts of OA on fisheries as a whole could be much higher. The sentence as written refers to the impacts on fisheries, while the Brander et al. 2012 paper focuses on coral reefs.
573	80751	19	28	44	28	47	I suggest to link to CC-CR and make sure that there is consistency. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	Reference has been made to the CR box in the new Table 19-3, which replaces this text and the figure it refers to.
574	64558	19	28	45	28	45	why not "very likely"? "virtually certain" might be a bit too much, although there is high confidence that under increasing temperature and CO2, calcification rates will change (CC Box Coral Reefs, ch6 p 56 L 27-28) - and temp&CO2 will increase according to WGI) (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	The statement has been changed to "Changes in coral calcification rates are very likely" and references have been made to the CC-Coral Reefs box. Note that this sentence has been moved to a new Table 19-3.
575	64559	19	28	47	28	47	further below in p 28, Line 47 etc it reads "If such changes are representative of future changes to benthic calcifying systems, then the ecosystem services they provide will in turn be degraded" this supports rather high or very high confidence. please be more specific where the "medium" comes from ch6 p 44 L 4-9 reads for human activities in marine ecosystems under climate change in general " Attributing and projecting their climate-change-mediated shifts remains a challenge, partly because of the intrinsic difficulties of assessing these services, lack of long time-series data and confounding human impacts. However, available evidence from empirical and modeling studies provides high confidence that climate change impacts marine ecosystems, leading to changes in provision, regulation and supportive services, while there is limited evidence and medium agreement that climate change affect cultural services." (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	The magnitude of the impact to ecosystem services has been amended to "medium to high" in accordance with the assements in Box CC-CR. The latter part of this comment refers to climate change impacts in general, while here we are addressing ocean acidification. Note this text is now part of new Table 19-3.
576	64560	19	28	47	28	47	There is a number of studies that suggest changes in calcification (most species show a decrease, ch 6 p 25 L 27-32) ch 30.5.4.2.4 p 18 ch 6.2.5.6 (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	We have reorganized this text so that it now appears as new Table 19-3. Within the table, we have made specific references to the appropriate sections in Chapter 6.
577	80752	19	28	47	28	50	Rephrase because Hall-Spencer did not report on corals. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	This text has been removed.
578	60115	19	29	9	29	10	Explain how "... with sufficient information Low, Medium and High magnitudes of impacts would be defined quantitatively". (AUSTRALIA)	This sentence has been removed in the overal revision of the section.
579	61494	19	29	10	29	10	Could be clearer what the risks/ implications for mitigation strategies are in this context. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This figure has been removed and the caption eliminated. It has been replaced by Table 19-3.
580	64561	19	29	17	29	19	isnt this a repetition of ch 19 p 28 L30-37? (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	These two paragraphs have been rewritten in the context of the four criteria for determining risk.
581	80753	19	29	18	0	0	Evidence is indeed limited in situ where the only published study reported no stimulation of nitrogen fixation under elevated pCO2 (Law C. S., Breitbarth E., Hoffmann L. J., McGraw C. M. & Langlois R.J. L. J., Marriner A. & Safi K.A, 2012. No stimulation of nitrogen fixation by non-filamentous diazotrophs under elevated CO2 in the South Pacific. Global Change Biology 18:3004-3014.) (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	Agreed, no change to text is necessary.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
582	77748	19	29	18	29	18	Please provide a detailed link pointing to the traceable account of the evaluation of the evidence. (Francis Zwiers, Pacific Climate Impacts Consortium)	This statement has been rewritten as part of new Table 19-3, and reference to a specific section of Chapter 6 has been provided.
583	83013	19	29	18	29	18	It would be preferable to provide specific reference to the relevant sections of chapter 6. Additionally, "limited evidence" should be italicized for clarity. (Katharine Mach, IPCC WGII TSU)	The statement has been rewritten in the context of the four criteria for determining risk as part of new Table 19-3, and the designation of limited in situ evidence has been italicized and attributed to the appropriate text in Chapter 6.
584	83014	19	29	24	29	28	The chapter team should consider presenting calibrated uncertainty language for these statements, given the discussion of evidence. (Katharine Mach, IPCC WGII TSU)	We have added the confidence language "medium to high confidence".
585	83015	19	29	42	29	42	Specific cross-reference should be provided for the relevant subsections of chapter 7. Additionally, throughout the paragraph, should further cross-reference be provided to material in Chapter 7? (Katharine Mach, IPCC WGII TSU)	"(see chapter 7)" has been added. Specific subsections will be referenced when FGD drafts are available.
586	62594	19	29	42	29	44	To provide balance, the potential enhancemnt of plant productivity under elevated CO2 could be mentioned. This is discussed in WG1, Chapter 6 (INDIA)	This is additionally covered extensively in WG2 Ch 7. This section deals with emergent risks, not benefits. With tight space limits, we are unable to discuss benefits.
587	77749	19	29	51	29	51	I think the assessment that nutritional value is declining should be presented using calibrated confidence language. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have added "medium confidence" that this risk has the potential to become key.
588	57830	19	30	3	30	48	Nice discussion in a very difficult area. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Thanks.
589	62592	19	30	3	30	48	The biggest risk from geoengineering could be diversion of discussion and actions on greenhouse gas emission reductions. This could be mentioned here. (INDIA)	It s not clear that the "moral hazard" is the biggest risk, but we have added it.
590	80569	19	30	3	31	9	A recent paper by Haywood et al (2013, Nature Climate Change) is relevant here, studying potential effects of SRM on regional climate changes. (Richard Betts, Met Office Hadley Centre)	We have added this reference.
591	62590	19	30	5	30	11	It would be good to mention here that WG3 (chapter 6) assesses the cost and the implications of some CDR and SRM methods for climate stabilization pathways. (INDIA)	We have added this reference.
592	77750	19	30	6	30	6	Also mention Ch 7, WG1, here? (Francis Zwiers, Pacific Climate Impacts Consortium)	We have added this reference.
593	62589	19	30	6	30	7	According to the report from IPCC expert meeting on geoengineerng, there is some overlap between CDR and mitigation. The statement here seem to contradict that. (INDIA)	Reference to the IPCC report added to the discussion, now in the first paragraph.
594	65057	19	30	8	0	10	We believe the speculative nature of current geoengineering proposals must be made clear. Suggested insertion in caps: "The main THEORETICAL benefit of geoengineering would be the reduction of climate change that would otherwise occur with an associated reduction in impacts (Pongratz et al., 2012; section 19.7.1)." (Action Group on Erosion, Technology and Concentration (ETC Group))	We have edited the text in this spirit by adding "intended benefit" rather than "theoretical benefit" since we believe that is more precise.
595	62588	19	30	10	30	10	The reference "Pongratz et al. 2012" for introduction of geoengineering is inappropriate. This work modeled the impacts on crop yields only. The Royal Society Report on Geoengineering 2009 is probably an appropriate one here. (INDIA)	We have changed this reference as suggested.
596	77516	19	30	10	30	10	This line appears to reference section 19.7.1 as covering the main benefits of geoengineering. 19.7.1 does not do this and the entirety of WGII, as far as I can see, is without any clear explanation of the potential benefits of geoengineering (Andrew Parker, Harvard Kennedy School)	We have removed reference to 19.7.1. We have retained the statement about benefits of geoenginering but have not expanded on it because the topic of this chapter is risks rather than benefits.
597	57503	19	30	13	30	13	Geoengineering is not an emerging risk… It is a lame expression. Geoengineering is not a risk but an action which could be risky. (Alexey Ryaboshapko, Institute of Global Climate and Ecology)	The "emerging risk" language has been dropped from the chapter and we refer now to "newly assessed risks". Also geoengineering itself is not the risk, but rather its consequence present a risk. For this reason the title of the section is "Risks from geoengineering".

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
598	77517	19	30	13	30	18	Sentence grossly over-generalises by lumping all geoengineering techniques together, and it misleads by not specifying that many of the risks of individual techniques would only be incurred if they were deployed at large scale. It alsot glosses over the potential for large reductions in climate risks from some of the techniques. It would more accurately read “some aspects of some geoengineering techniques (if deployed at a large scale) would present emerging risks”. For example it is hard to envisage the large risks that ambient air capture (defined as geoengineering under IPCC definitions) would present if the tech can be made cheap enough for example. And it is hard to see that space mirrors present a significant emerging risk if they are only talked about but never leave the land of theory. (Andrew Parker, Harvard Kennedy School)	The text has been rearranged and edited to first make clear that geoengineering refers to SRM, and then afterwards discusses risks of that particular class of approaches. We have also added text to the first sentence of the section that defines geoengineering as being at large scale.
599	77518	19	30	14	30	15	Fleming’s work of popular science, not academia, does not detail previous geoengineering experiments but confuses geoengineering for weather modification. If the IPCC wants to treat weather modification as geoengineering that’s fine, but it will have to rewrite WG1, and all of the references in WGII also. This sentence should be removed. (Andrew Parker, Harvard Kennedy School)	The IPCC does not treat weather modification as geoengineering, although in the special report on geoengineering it says, "Geoengineering is different from weather modification and ecological engineering, but the boundary can be fuzzy." We retain the reference to Fleming's book because it details ideas and attempts to modify the climate of the entire Earth as well as weather modification.
600	63720	19	30	18	30	19	The exact explanation for CDR is "Carbon Dioxide Removal". Please reformulate, e.g.: "Geoengineering has come to refer to both carbon dioxide r e m o v a l, t h r o u g h a r e d u c t i o n o f i t s a t m o s p h e r i c c o n c e n t r a t i o n (CDR...) ..." (GERMANY)	We have corrected the language referring to CDR.
601	83016	19	30	19	30	30	It would be preferable to provide specific cross-reference to relevant sections of working group 1 chapter 6 and 7. Also, lines 20 and 29 are a bit repetitive. (Katharine Mach, IPCC WGII TSU)	Reference to specific WG1 sections has been added.
602	77519	19	30	21	30	21	Is Izrael 2009 really the best reference for different scientific issues raised by geoengineering? Off the top of my head I would recommend Lenton and Vaughan 2009, or the Royal Society 2009 (Andrew Parker, Harvard Kennedy School)	We have replaced the Izrael reference with reference to the Royal Society report.
603	63721	19	30	22	30	23	Please consider the large uncertainties attached to geoengineering. Furthermore, it is advisable to distinguish geoengineering approaches from mitigation. If you would like to differentiate some CDR approaches from other, you might want to give an example. Please reformulate, e.g.: "S o m e a p p r o a c h e s to CDR (e.g. >>> EXAMPLES COULD BE INSERTED HERE>>>) c o u l d p o t e n t i a l l y o f f e r a p o s i t i v e c o n t r i b u t i o n s i m i l i a r t o m i t i g a t i o n..." (GERMANY)	Uncertainties related to the consequences of geoengineering for the climate system are covered in WG I, Chapter 6.6. We refer to this section, but do not have space to discuss them here. Also, given that we focus on SRM, we limit our discussion of CDR.
604	79640	19	30	22	30	23	This statement seems at odds with the definition of geoengineering in the glossary. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	We believe this statement is consistent with the Glossary definition of CDR, which says, "The boundary between CDR and mitigation is not clear and there could be some overlap between the two given current definitions."
605	76780	19	30	22	30	27	whilst it may be true that CDR represents smaller PHYSICAL CLIMATE impacts and risks, I don't think it is generally true thiat it can be considered less risky. Demand/competition for land and subsequent impact on food production for example is a key area that needs to be understood much better. CDR via massive re-use of agricultural land could have very detrimental effects (Chris Jones, Met Office)	The topic of competition for land is covered in 19.4.1. Given space constraints we have added mention of this issue and referred to that section.
606	63722	19	30	23	30	25	Please consider the large uncertainties attached to geoengineering and reformulate, e.g.: "…and, a s o f t o d a y, CDR is thought to produce m o r e m a n a g e a b l e r i s k s than SRM if the CO2 c o u l d a c t u a l l y be removed from the atmosphere efficiently and stored safely." (GERMANY)	We have edited the text to add more caveats to the statement that CDR is thought to produce more manageable risks, which we believe the best way to indicate the uncertainty.
607	63723	19	30	25	30	27	This phrase gives too much the impression CDR would have a low risk profile. This is not the case (considering e.g. ocean fertilization). Please reformulate: "….Royal Society 2009). Nevertheless various unsolved questions and risks as for CDR exist. But because of the more substantial recent literature...." (GERMANY)	We have edited the text to add more caveats to the statement that CDR is thought to produce more manageable risks, which we believe the best way to indicate the uncertainty.
608	61495	19	30	29	30	40	The authors could cite the Haywood et al (2013) paper in Nature Climate Change (doi:10.1038/nclimate1857) on the impacts of stratospheric aerosol injection on Sahelian rainfall, according to the regional patterns of injection. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have added this reference.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
609	76781	19	30	29	30	40	Yes - geographic distribution of impacts is important to discuss here. Also important are the geographic distribution of the forcing - see e.g. Haywood et al., (Nature Climate Change, 2013) who show very different impacts for hemispherically-assymetric stratospheric loading (Chris Jones, Met Office)	We have added this reference.
610	63724	19	30	29	30	48	You should add that knowledge on SRM is in general very limited and that it could be revised by possible future findings. (GERMANY)	We added a statement of "low confidence" in current understanding in order to reflect uncertainty.
611	65058	19	30	30	0	32	Again, we believe the speculative nature of current geoengineering proposals must be made clear. Suggested edits: "...two approaches that have received attention because they have been assumed to be technically feasible, effective and inexpensive (Salter et al., 32 2008; Lenton and Vaughan, 2009; McClellan et al., 2012)." Comment: We do not know if geoengineering is going to be inexpensive (as proponents insist) – especially if/when geoengineering doesn't work as intended, forestalls constructive alternatives, causes adverse effects and/or "locks in" future generations. We do not know how to recall a planetary-scale technology once it has been released or the costs of doing so. These points are made in ETC Group, "Darken the sky and whiten the earth: The dangers of geoengineering," _Development Dialogue_ no. 61, September 2012, pp. 210-237. (Action Group on Erosion, Technology and Concentration (ETC Group))	Text has been edited to reflect these ideas.
612	77751	19	30	31	30	31	This sounds like an assessment is being made ("seem to have the potential …"). I think the language needs to be more circumspect, and more carefully nuanced. Certainly words like "inexpensive" should not be used. (Francis Zwiers, Pacific Climate Impacts Consortium)	Language has been edited to be more precise and nuanced, and "inexpensive" has been eliminated.
613	77520	19	30	32	30	32	Observations of volcanic eruptions very probably do not represent a realistic analogy of what SRM deployment would look like. Why would people choose suddenly to turn the system on at absolutely full scale? (Andrew Parker, Harvard Kennedy School)	We retain the short discussion of volcanic analogues because the response to volcanic eruptions is linear, and they serve as an analog to some potential impacts. The impacts for which they are not a good analog are not mentioned.
614	57504	19	30	32	30	36	Risk of ozone depletion maybe overestimated. Observed reduction of total ozone after volcanic eruptions is connected (most probably) with ozone destruction on surface of volcanic ash solid particles which posse high relative surface as distinct from spherical liquid (semi-liquid) sulfate particles (citation: Deshler T., Nardi B., Hofmann D.J., and Johnson B.J., 1996. Correlations between ozone loss and volcanic aerosol at altitudes below 14 kilometers over McMurdo station, Antarctica. Antarctic Journal of the United States, Vol. 25, No 2). In accordance with generally accepted conception on stratospheric ozone destruction anthropogenic freons play a key role in the process. Freon's concentrations in the stratosphere drop down now and by the middle of the 21-st century they can be negligible. On condition that lack of freons (and active forms of chlorine) stratospheric sulfate particles could even promote ozone generation (citation: WMO, 2007. WMO (World Meteorological Organization), Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project – Report No. 5, 572 pp., Geneva, Switzerland). Model simulations demonstrate that such situation can be realized during coming decades (citations 1: Tie X.X. and Brasseur G.P., 1995. The response of atmospheric ozone to volcanic eruptions: sensitivity to atmospheric chlorine loading. Geophys. Res. Lett., 22, 3035-3038; citation 2: Robock A., 2000. Volcanic eruptions and climate. Reviews of Geophysics, 38, 2, pp. 191-219; citation 3: Lane L., Caldeira K., Chatfield R., and Longhoff S., 2007. Workshop Report on Managing Solar Radiation. L. Lane, K. Caldeira, R. Chatfield, S. Langhoff (eds.). Report NASA/CP-2007-214558, November 18—19, 2006. 40 P.). (Alexey Ryaboshapko, Institute of Global Climate and Ecology)	Agreed. We have revised the text to indicate that the risk of ozone depletion depends in detail on how much and when stratospheric aerosols would be used in the stratosphere.
615	62591	19	30	33	30	34	The weakening of global water cycle for SRM geoengineering is a fundamental science that has emerged since AR4. This is a huge risk from SRM and the appropriate reference (Bala et al. PNAS 2008) could be cited (INDIA)	We have added mention of this topic and reference.
616	77521	19	30	34	30	35	This sentence is incomplete and therefore misleading as it is, for several reasons The majority of the modelling studies of SRM deployment to date indicate that SRM deployment would likely reduce hydrological disruption caused by climate change, and fetishising rainfall over system moisture is a very bad mistake. Studies of SRM show some expected reduction in rainfall (relative to a world of climate change) but also an expected reduction in evaporation. Mentioning one without the other is carelessly misleading. And is a study of pre-industrial famine really the best source of information about the possible effects of SRM, when so many recent studies have look specifically at the topic? If not, its inclusion in misleading. (Andrew Parker, Harvard Kennedy School)	The reference to famine has been removed. There are no studies of volcanic eruption impacts on soil moisture. And this sentence is about volcanic analogs, not about modeling, which is addressed in the next sentence.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
617	78329	19	30	35	30	35	The word "famine" does not appear in Oman et al 2006 so it is strange to cite this for risk of famine. Oman et al 2006 contains a claim in the abstract with absolutely no supporting analysis in the underlying paper ("Future high-latitude eruptions would significantly impact the food ... supplies in these areas. ") This is just an assertion. Theere is no crop model, no analysis of crop productivity, nothing. One would assume the IPCC would have higher standards of evidence before making assertions. (Ken Caldeira, Carnegie Institution for Science)	The reference to famine has been removed. Note however that the word "famine" is in the paper originally referred to. Unfortunately, the reference was not in the SOD. It is: Oman, L., A. Robock, G. L. Stenchikov, and T. Thordarson (2006), High-latitude eruptions cast shadow over the African monsoon and the flow of the Nile, Geophys. Res. Lett., 33, L18711, doi:10.1029/2006GL027665.
618	78330	19	30	35	30	37	The words "ozone depletion" appear several times in this paragraph. Estimated ozone depletion due to Mt Pinatubo has been estimated at up to 10% in some regions (Brasseyr and Granier, 1992) and about 3% on the global mean. I believe Tilmes and Rasch came up with global numbers similar to these. "Ozone depletion" gives the impression that the ozone is really depleted, which is typically defined as "used up, exhausted". Better and more accurate would ne to say "some ozone loss". If the author team is enamored with the word "depletion", it should be "some ozone depletion" or "partial ozone depletion". (Ken Caldeira, Carnegie Institution for Science)	We retain the phrase "ozone depletion" since it is common scientific usage. We have edited the text on ozone to indicate that the risk of ozone depletion depends in detail on how much and when stratospheric aerosols would be used in the stratosphere.
619	57505	19	30	36	30	36	“reduce electricity generation…”. Geoengineering deployment would reduce direct sunlight at 3% (this is maximum). Nowadays solar energy provides 0.05 % of world energy. This figure can increase up to 16 % by 2040. Then world energy system will lose 0.0048 % due to geoengineering deployment. This loss is unessential at the world scale (especially if we compare this loss with benefit which could be obtained from geoengineering application). (Alexey Ryaboshapko, Institute of Global Climate and Ecology)	The statement is correct and may be important locally.
620	57506	19	30	36	30	40	At the same time climate modeling shows that if SRM geoengineering would stabilize the global temperature on the level of +2C during 21-st century, average global precipitation could be the same as in the beginning of the century (citation: Izrael Yu., Volodin E., Kostrykin S., Revokatova A., Ryaboshapko A., 2013. Possibility of geoengineering stabilization of the global temperature in the 21-st century using stratospheric aerosol and evaluation of possible negative consequences. Meteorology and Hydrology (accepted for publication in 2013) (in Russian). (Alexey Ryaboshapko, Institute of Global Climate and Ecology)	We did not have access to an English translation of this paper in time to take it into account.
621	77522	19	30	37	30	38	Why on Earth are the effects of SRM on monsoon cycles being compared to today's climate??? This is an irrelevant and misleading comparison. Comparisons should be to a world of climate change (which is what is modelled in all of these studies) (Andrew Parker, Harvard Kennedy School)	We have retained the comparison to current climate because the model simulations in many experiments attempt to keep the global average surface temperature constant at current levels. With this aim, the hydrological cycle would weaken.
622	78328	19	30	38	30	39	No study has ever demonstrated that the predicted changes potentially threaten the food supply for billions of people. That was something made up by Alan Robock without any modeling of food supply. The only published study (Pongrat et al 2012) concludes that crop productivity should increase, not decrease, in most places due to injection stratospheric aerosols. It does not seem to be appropriate for the IPCC to be including one person's unsupported claim as if it were a fact. This is especially true because Robock used a model (GISS) that performs just about the worst of any model on simulating the monsoon. And since when does the IPCC trust single model projections for small regions? (Ken Caldeira, Carnegie Institution for Science)	Pongratz et al. (2012) assumed the climate would not change much, and got crop production increases mainly due to CO2 fertilization. The statement on the food supply for billions has been removed and replaced with, "The net effect on crop productivity would depend on the specific scenario and region (Pongratz et al., 2012)."
623	77523	19	30	39	30	39	Speculates that some changes to the monsoon (which are modelled in a minority of studies) would “potentially threaten the food supplies to billions of people”. If this standard of conjecture were applied throughout IPCC then the report would be twice as long and half as credible (Andrew Parker, Harvard Kennedy School)	The statement on the food supply for billions has been removed and replaced with, "The net effect on crop productivity would depend on the specific scenario and region (Pongratz et al., 2012)."
624	57507	19	30	42	30	45	However it should be noted that such risk can be avoided (or considerably reduced) by graduate cessation of the geoengineering application if needed (citation: Izrael Yu., Volodin E., Kostrykin S., Revokatova A., Ryaboshapko A., 2013. Possibility of geoengineering stabilization of the global temperature in the 21-st century using stratospheric aerosol and evaluation of possible negative consequences. Meteorology and Hydrology (accepted for publication in 2013) (in Russian). (Alexey Ryaboshapko, Institute of Global Climate and Ecology)	We have clarified that the risks of cessation that we refer to are for sudden halting of geoengineering measures.
625	61496	19	30	42	30	48	Given the chapter's engagement with the recursive nature of climate impacts, policies and risks, would it be suitable here to bring in arguments about the moral hazard of geoengineering - i.e. that SRM roll-out would undermine current efforts at mitigation and adaptation. For example, see Lin (2012) 'Does geoengineering present a moral hazard', Ecology Law Quarterly (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The moral hazard idea and the Lin reference have been added.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
626	77752	19	30	44	30	44	Presumably Russell et al did not make an assessment using calibrated uncertainty terms (but the text gives that impression). Very likely would imply high or very high confidence, and thus a substantial body of evidence. Is this the case? (Francis Zwiers, Pacific Climate Impacts Consortium)	The language in Russel et al. is that "Such rapid changes would almost certainly have very large harmful impacts on ecosystems." Given that it is a review paper from a large group of authors on ecosystem impacts, we are comfortable translating to calibrated uncertainty terms.
627	78247	19	30	46	0	0	As there is no reference on the conflict potential of geoengineering here, you may refer to the special issue: Brzoska, M., Link, P.M., Maas, A. & Scheffran, J. (eds.) (2012): Geoengineering: An Issue for Peace and Security Studies?, Sicherheit & Frieden / Security & Peace, Special Issue, 30 (4/2012). (Jürgen Scheffran, University of Hamburg)	We have added this reference.
628	63725	19	30	46	30	46	SRM only appears to be inexpensive as for its direct costs (if external effects are not considered). Please reformulate. (GERMANY)	We have clarified the text to indicate that we refer to direct costs and we give the actual estimate rather than characterizing it as inexpensive.
629	77524	19	30	46	30	46	Should read "...could present a risk for international conflict. " It is correct to point out that deployment of SRM could cause a risk of conflict if deployed without appropriate agreement and governance, especially in a section about the potential risks of SRM. However... an accurate and balanced report would point out that SRM, if successful at slowing the rate of warming or stopping it altogether, could drastically reduce the risk of conflict from climate change. However, this does not appear in the earlier section on climate and conflict. See my general comments about the report for suggestions on addressing this. (Andrew Parker, Harvard Kennedy School)	The first paragraph of the section refers to the benefits of geoengineering, and also indicates that we focus on risks due to the focus of the chapter.
630	63726	19	30	51	0	0	It would make more sense to have this section before 19.4 and 19.5, because the aspects described here, already manifest itself and are thus somehow "closer" than the emerging risks. When I started to read this, I somehow got the feeling to take a step back. (GERMANY)	We think the logical order requires discussion the details of risk discussed in 19.3-19.5 before distilling them into the "key" ones.
631	79984	19	30	51	38	15	Section 19.6.1: there is a lot of focus on human systems, and little on biological systems, although the criteria for identifying key vulnerabilities (19.2.2.1) points also to social-ecological systems. Please consider including more findings related to b (NORWAY)	We have a full part on environmental vulnerability that shows the importance of environmental systems.
632	60116	19	31	9	0	0	An example to illustrate the interaction of moderate vulnerability and a large climate impact may be useful here. (AUSTRALIA)	The sentence has been deleted, however, an example could be severe sea level rise above 2 or 4 meters in low laying regions in developed countries.
633	60117	19	31	11	0	0	The comprehensive Table 19-3 could be inserted here, after it is mentioned for the first time on line 3. It may be useful as a Summary of the key vulnerabilities, risks and reasons for concern before they are elaborated in the later sections. (AUSTRALIA)	The point is considered, however we felt it best to place the table directly following the point at which it is fully described for the first time (within 19.6.2.1, which is not too far from this section). Table 19-4 is now also a product of the SPM.
634	66309	19	31	12	34	54	This section is organised according to attributes of vulnerability, rather than coming out directly (as in the next section on Key Risks) with a list of key vulnerabilities. Couldn't some concrete generic examples be listed, and the section organised around these? There are numerous examples in the regional chapters, e.g. vulnerability of indigenous populations; vulnerabilities due to rapid urbanization; vulnerability because of low capacity to manage adaptation funds effectively (Timothy Carter, Finnish Environment Institute)	The dimenions are more important, since it is almost impossible to generate a comprehensive list of items of vulnerability - hence we should refer in the different dimensions to different examples discussed in other chapters. The overall logic is the differentiation of vulnerability into core factors (susceptibility/sensitivity, lack of coping and adaptive capacities - the skeleton of vulnerability) and the different dimensions in which this skeleton might appear - social vulnerability, economic vulnerability, environmental vulnerability and institutional vulnerability.
635	83017	19	31	19	0	0	Section 19.6.1.1. In revising the section, the chapter team should consider if "exposure" should be included in the subsection title and the 1st paragraph of the subsection. (Katharine Mach, IPCC WGII TSU)	Exposure is a pre-conditions to judge a vulnerability key, but it is not fully a factor of vulnerability. Overall, exposure is a hybrid between vulnerability and hazards.
636	84386	19	31	19	0	0	Section 19.6.1.1: Currently there is a good deal of overlap with section 19.6.1.3, and it would be useful to more clearly separate these sections. (Michael Mastrandrea, IPCC WGII TSU)	The sections have been modified and the overlap is reduced.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
637	60649	19	31	27	0	0	Further the SREX notes that the increased intensity, frequency, and duration of extreme events, as climate change becomes more extensive may dominates impacts. As such, adaptation based only on recent experience or extrapolation of historical trends could be largely ineffective (George Backus, Sandia National Laboratories)	This is a good point we also consider, but it is less relevant for the vulnerability section here, since our new conceptualization of vulnerability clearly shows that vulnerability is driven by socio-economic, demographic factors etc. Hence, the point refers to the risk discussion we also have in the chapter.
638	57831	19	31	31	0	0	in Asia - Why just highlight Asia? I agree that Asia has a problem but so do the other continents. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Asia is an example and recent studies e.g. Peduzzi et al. - or Birkmann et al. 2013 show that in terms of different population scenarios, Asia will be THE global hotspot of exposure. The core question for policy makers and scientists might be whether this increase in exposure also means an increase in vulnerability or whether the e.g. increase in wealth and the development of risk reduction and adaptation measures for example in coastal urban areas will perhaps even reduce vulnerabiliy - even though exposure is increasing.
639	57832	19	31	41	31	49	The discussion is ok but not clear. Why not just say that in some cases the history of a given location is important in understanding its vulerability. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The wording that the history of a place can also influence vulnerability would be less precise. There are definitly papers that also discuss the colonial influence on peoples vulnerability to hazards - e.g. Case study Peru - but the point we want to make here is that crises and disasters might modify vulnerability - hence crises and disasters might also open new opportunities for risk reduction and adpatation if they the responses to these crises are addressing core determinats of vulnerability and risk.
640	77753	19	32	6	32	6	I'm worried about the formulation here and the possibility that it might be interpreted in ways other than intended. I can accept the notion that there is an association between exposure patterns and factors such as race and ethnicity, but I think it would be highly inappropriate to say that such a factor DETERMINES (my emphasis) or influences exposure patterns. In statistical terms, correlation does not necessarily imply causation. The wording that begins on line 11 explaining that the thing that really matters is whether an individual belongs to a group that is marginalized seems, to me, to be more appropriate. (Francis Zwiers, Pacific Climate Impacts Consortium)	The assessment of the existing literature somehow shows this. It also depends on the hazard, but for example it is widely acknowledged that marginalization contributes to differential exposure patterns, e.g. Poor people in flood plains or directly at the beach - e.g. due to the limited access to land. These spaces are often public land that encroachers use or migrate to - due to limited alternatives. However, we see the point that this could be missunderstood and one would have to add more text to it. Therefore, we took out the reference to exposure here and only refer to vulnerability. Thus the text has been modified.
641	77328	19	32	9	32	11	An important addition in this line of research is a quantitative approach to assess climate vulnerability of smallholders based on similarities at the household level as presented in Sietz et al. (2012). This typology of smallholder vulnerability to weather extremes in the Peruvian Altiplano reveals distinct groups of smallholders with regard to their ability to meet food requirements and sustain livelihoods. As a particular focus, this study presents an elaborate way of validating the identified typology using outcomes of a specific exposure and reported mechanisms from independent information sources. Such a validated and manageable categorisation of the heterogeneous characteristics of smallholder households provides a solid basis for better understanding regional development. REFERENCE: Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2012) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Regional Environmental Change 12(3): 489 - 505. (diana sietz, Wageningen University)	This reference has been assessed and is cited several times in this paragraph.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
642	70760	19	32	11	0	0	Maybe add the following reference here: Kienberger, S., Blaschke, T., Zaidi. R.Z., (2012). A framework for spatio-temporal scales and concepts from different disciplines: the 'vulnerability cube'. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0513-x (Stefan Kienberger, University of Salzburg)	The point we want to make here is that quantitative and qualitative vulnerability assessments at different scales are already applied and used to capture differential vulnerabilities. The paper of Kienberger et al. 2012 is good, but focuses more theoretically on what different scales mean or could imply in vulnerability assessments in DRR and CCA.
643	77325	19	32	14	32	14	correct citation: Sietz et al. 2012 (diana sietz, Wageningen University)	This has been corrected.
644	83018	19	32	21	0	0	Section 19.6.1.3. Should "exposure" be included in the title of this section, as well as in the titles of the subsections that follow? (Katharine Mach, IPCC WGII TSU)	Exposure' has been inserted into the title of this section.
645	69448	19	32	23	32	23	The paragraph 19.6.1.3 starts with "Vulnerability and exposure of societies and social-ecological systems...". In the TS and SPM this changes to "Vulnerability and exposure of communities or social-ecological systems...". There are differences between societies and communities. The term society is more general, and it also refers to a social kind of organization, like human ones, but not all communities are social. In a biological context, community can refer to a community of animals or plants. In this case it is clear from the content of the paragraph that the the subject is human, so in the summaries the term "communities" should probably be changed to "societies". (NETHERLANDS)	Correct point - both terms are still OK - perhaps societies is a more overarching and general terms and includes communities.
646	83019	19	32	23	32	35	This material could be tightened, as some sentences are overlapping within the paragraph and with previous subsections. (Katharine Mach, IPCC WGII TSU)	We shortened the section overall.
647	70759	19	32	31	32	33	It is important to add, that vulnerability assessments can be characteriszed by temporal, spatial and also thematic 'dimensions' (what kind of vulnerability is being assessed). Kienberger et al. 2012 reviewed a set of 20 vulnerability assessments in regard to their spatial, temporal and thematic dimensions. Additionally the paper highlights the importance of different 'kinds of scales', where the intrinsic scale of a phenomena has to be in line with the observational scale, the modelling scale and the policy scale where a vulnerability assessment is addressed to. This different kinds of scales are important to be considered when designing a vulnerability assessment. Such 'scale' specific issues, based on this kinds of scales could be mentioned here. The full citation is: Kienberger, S., Blaschke, T., Zaidi. R.Z., (2012). A framework for spatio-temporal scales and concepts from different disciplines: the 'vulnerability cube'. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0513-x (Stefan Kienberger, University of Salzburg)	The systematization of vulnerability assessment according to different temporal, spatial and thematic dimensions is an interesting and valid point, however, the core issue we deal with in this paragraph is that vulnerability trends need to be better understood and therefore changes of vulnerability over time and in space. This is slightly different from the question on whether or not it is possible and appropriate to classify different vulnerability assessments according to the criteria temporal, spatial and thematic dimension.
648	77754	19	32	41	32	41	I think "drought risk" should be replaced with "the [socioeconomic] risk that is produced by drought". For me (and I suspect for many), "drought risk" would be understood to be the risk of drought. (Francis Zwiers, Pacific Climate Impacts Consortium)	Interesting point, but the alternative suggestion is also not that helpful - since the cause of risk is here also solely linked to the natural phenomena - drought - which is not correct. We now use the wording "risk due to droughts" which is also not perfect, but perhaps most adequate.
649	83020	19	32	41	32	42	"high confidence" could be placed at the end of the sentence to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	Done
650	83021	19	32	45	32	45	It would be preferable to cross-reference the specific relevant subsections of chapter 13. (Katharine Mach, IPCC WGII TSU)	This sentence has been revised and the general reference to Chapter 13 has been removed.
651	57833	19	32	51	0	0	Type-o - develop => developed. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	corrected
652	61497	19	33	11	33	13	Much more substantiated information is needed here about the emergence of new vulnerabilities in relation to socioeconomic changes (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The text has been modified and an example and a reference is given, e.g. Greece and the risk of poverty of elderly.
653	74200	19	33	11	33	13	This paragraph is missing citations. (UNITED STATES OF AMERICA)	Text has been modified and an example on Greece is given. Greece might also be a good example, since the current economic conditions will probably increase the risk of poverty for elderly - due to heavy budget cuts.
654	84387	19	33	11	33	13	Please add citations to support these statements. (Michael Mastrandrea, IPCC WGII TSU)	Text modified and an example with a respective reference is provided.
655	83022	19	33	28	33	28	Should coastal flooding be explicitly mentioned? (Katharine Mach, IPCC WGII TSU)	Agreed. Coastal flooding has been added.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
656	79985	19	33	44	33	44	Please consider adding "upon which human societies rely on for their existance" to generate "The environment provides a range of ecosystem services (see e.g. MEA 2005) upon which human societies rely on for their existance, and that are at risk…" (NORWAY)	Text has been modified
657	79986	19	33	45	33	46	All human societies depend on ecosystem services for their survival (e.g. food, air, water), please use a more general statement. (NORWAY)	Agreed and hence we modified the text/sentence.
658	77755	19	33	47	33	47	It might be better to use confidence language here since the "event" to which the likelihood (a probability) is being applied is not very specific, and thus hard to quantify. Also, while several general links back to the evaluation of the supporting evidence are provided, specific pointers to the traceable account supporting the assessment would be good to include. (Francis Zwiers, Pacific Climate Impacts Consortium)	Yes, we have inserted a confidence statement.
659	84388	19	33	47	33	47	The quantitative basis for the probabilistic "very likely" here is not clear. This context may be better suited to a confidence assignment. (Michael Mastrandrea, IPCC WGII TSU)	Has been modified into a confidence statement
660	77756	19	33	49	33	51	Do these reports draw a specific link to climate change - and does the Chapter have confidence in their assessments? I suppose that would be the case for the SREX report, but is this also the case for the UNDP and UNEP reports? As in other places in this chapter, assessment is needed as well as reporting. And since the cited reports are weighty documents, I think it would also be necessessary to cite specific locations in the reports where the evidence that is referred to is developed. (Francis Zwiers, Pacific Climate Impacts Consortium)	The Global Environmental Outlook (GEO report) is used here as a source - cited as UNDP 2007. The report involves various scientists around the globe and also encompasses a review process. Consequently, the quality is normally quite high. Some of the authors of the GEO reports are and were IPCC Lead Authors. The report underscores that human vulnerability is also negatively influenced and determined by environmental conditions. The GEO report refers to the importance of environmental conditions for human wellbeing in various parts, various examples highlight the interlinkages and challenges of environmental change and opportunities that the environment provides for human wellbeing. Consequently, various parts also underscore that environmental degradation (including greenhouse gas emissions) threaten human wellbeing. Chapter 7 deals particularly with vulnerability.
661	79987	19	34	3	34	6	Please consider reflecting this finding also in the TS and possibly in SPM. (NORWAY)	We considered this e.g. In the SPM table on key risks and key vulnerabilities
662	83023	19	34	9	0	0	Section 19.6.1.3.3. Are there forms of institutional vulnerability in developed countries that would be relevant to include in this subsection? (Katharine Mach, IPCC WGII TSU)	We refer now also particualrly to governance aspects at the local level that are highly relevant for developing and developd countries. One could also provide here nice examples, such as the differences between risk governance in New Orleans (Hurricane Katrina) and New York (Hurricane Sandy) - but this would require more text and hence we just refer to the local issues that are relevant for both.
663	61498	19	34	11	34	30	Can the discussion of institutional vulnerability and governance be extended beyond failed or corrupt states? Other relevant factors include institutional capacities, scale, local accountability, cross-sectoral linkages, and so on. See for example Arun Agrawal in 'Social Dimensions of Climate Change', 2010 (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	These points have now been taken into account.
664	83024	19	34	15	34	15	It would be preferable to reference the specific relevance of sections of chapter 12. (Katharine Mach, IPCC WGII TSU)	We have removed the general Chapter 12 reference and in the section have inserted more references to the respective scientific literature.
665	69449	19	34	25	34	25	The reference to the "World Development Report 2011: Conflict, Security and Development" is missing. This is the only reference provided on the connection between violence and climate change. Since this concept is also mentioned in statements in the TS and SPM and supported by limited evidence, it is probably worth mentioning other studies (even grey literature) that focus on the relation between conflict and climate change. For example: Nordas & Gleditsch 2007, Climate change and conflict (Political Geography); Barnett 2003, Security and climate change (Global Environmental Change) *neither study is mentioned in the World Development Report itself. (NETHERLANDS)	More references are inserted to support some of the core findings here. However, the World Bank report is the main source that shows that countries with severe governance challenges were not able to reduce poverty. Other papers on the nexus of violent conflicts and climate change are now cited e.g. Barnett / Adger 2007

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
666	77757	19	34	28	34	30	The statement says, in effect, that there is high confidence that something is likely (under certain conditions), This seems to use likelihood and confidence language in a way that is in contrast with the intended usage of confidence and likelihood terms as described the guidance on uncertainties language. In that guidance, authors are first asked to assess the evidence, than assign a confidence level if there is sufficient evidence to do so, and finally if the confidence level is high enough, to assess a likelihood level (if the likelihood can be quantified). Here, I think the statement would be just as clear if the words "is likely to occur" were to be replaced with "will occur". If it is felt that this creates a statement that is stronger than can be supported by the evidence, then "high confidence" could be replaced with a lower level of confidence. (Francis Zwiers, Pacific Climate Impacts Consortium)	Sentence has been modified and additional supporting literature is cited.
667	83025	19	34	28	34	30	"high confidence" could be placed within parentheses at the end of the statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	This has been done.
668	84389	19	34	29	34	29	The ES uses "is to be expected" rather than "is likely to," and the ES wording may be preferable, as this does not appear to be a formal usage of "likely." (Michael Mastrandrea, IPCC WGII TSU)	Sentence has been modified and the use of 'likely' has been removed.
669	83026	19	35	5	0	0	Section 19.6.2.1. For the key risks assessed here, to what extent is it possible to indicate how they increase with level of climate change and other factors, how they differ in the near-term versus the long-term, and how risk can be reduced through adaptation? (Katharine Mach, IPCC WGII TSU)	These points are taken up in 19.6.3, which is now tied closely to the list of key risks in 19.6.2 with cross-referencing.
670	84390	19	35	5	0	0	Section 19.6.2.1: It is not completely clear why the key risks highlighted in the bullet list in this section were chosen and not others. In the paragraphs that follow the bullet list and discuss each one, it would be useful to more clearly explain the evaluation of the four criteria from 19.2.2.2 and why each was selected. In these paragraph, please also include cross-references to specific sections from other chapters rather than the chapters as a whole. (Michael Mastrandrea, IPCC WGII TSU)	We now have an extensive explanation of our basis for judgment.
671	77758	19	35	9	35	11	The explanation that it is "difficult to provide a comprehensive overview" sounds a bit like an admission of failure. Isn't this exactly what the governments would expect the IPCC to produce, and the type of material that should ultimately be expected to burble up to the SPM via the chapter's executive summary? (Francis Zwiers, Pacific Climate Impacts Consortium)	Agreed and considered. Sentence has been deleted.
672	66310	19	35	13	35	20	This is a perfectly reasonable list, and I find this to be a very effective way of treating the key risks. It is worth noting, as the authors may already have done, that Chapter 25 on Australia and New Zealand also lists eight key risks. Interestingly, these are categorised in the following way (my paraphrasing): Potential impacts can be delayed but not entirely avoided (two key risks); Potential to be severe but can be moderated or delayed significantly by mitigation and adaptation (four key risks); Low or currently unknown probability; major challenges if realised (two key risks). I wonder if some similar classification might be possible here, or are these risks too generic to allow for such nuance? (Timothy Carter, Finnish Environment Institute)	The new list of key risks considered our criteria and also was discussed in various iterations with the different chapters.
673	62954	19	35	16	35	16	Systemic risks (related to infrastructure failures) are not really addressed in Chpater23 (there one can find a rather sectoral discussion) and should receive more attention as key risks within the scope of this chpater (19). (Claudia Bach, United Nations University Institute for Environment and Human Security)	Risks were modified and also specific references to respective chapters are inserted.
674	74201	19	35	17	35	17	It is unclear what is meant by "serious harm and losses" - a more specific identification of the risk(s) would be useful. (UNITED STATES OF AMERICA)	Risks were modified and also specific references to respective chapters are inserted.
675	57834	19	35	19	35	20	These two bullets seem to be very similar to me. Combine? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Risks have been modified and one entry in Table 19-4 also underscores now the linkages between these areas.
676	80570	19	35	20	35	20	Also input from chapter 4? (Richard Betts, Met Office Hadley Centre)	Inputs have been gathered and systematized.
677	74202	19	35	22	35	25	It may be useful here to mention some of the other risks that were not included in the selected list of 8 above. (UNITED STATES OF AMERICA)	The scope of this chapter is to identify and illustrate key risks. Table CC-KR provides a quite good overview, but definitly there are risks that might be seen key that have not been included here. Our own judgement is that this chapter should focus on key risks and a list is provided.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
678	61499	19	35	27	35	38	Table 19-3: "Diarrhoea facilitated by higher temperatures" needs substantiation. Regarding the table more broadly, sometimes the links between the columns are obvious (with causal mechanisms), sometimes not. The logic of the table could be more fully explained in the caption, and perhaps the rationale for selecting these cases explained. Also change "life stocks" to "livestock" in Asia section (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The table has been modified and the input of different chapters has been refined.
679	57768	19	35	40	35	42	I don't think "e.g." is proper english to just stick in a sentence. Also, I think the example of rainfall patterns might be replaced with something like heat waves or droughts which are more reflected in climate trends at broad scales. (David Lobell, Stanford University)	The table and the text description of this key risk has been modified also due to newer input from other chapters.
680	74203	19	35	40	35	46	Access to food, markets, and seeds/tools/water/land/fertilizer/pestize in addition to availability of diversity of food and livelihoods are critical factors that affect food security and malnutrition. (UNITED STATES OF AMERICA)	Agreed and the bullet point has been modified, however, this input is also dependent on the information provided by the other chapters.
681	83027	19	35	40	35	52	It would be preferable to cross-reference specific sections of chapters mentioned in these paragraphs. (Katharine Mach, IPCC WGII TSU)	These paragraphs have been deleted and some of the content has been merged into the key risk bullet points, which have been expanded upon. Lines of sight have, however, been inserted in the key risk bullet points, Table 19-4, and CC-KR.
682	80571	19	35	41	35	41	After "major stress for rainfed agriculture" add "in some areas". (Richard Betts, Met Office Hadley Centre)	Has been modified and a revised bullet point has been developed.
683	83028	19	36	1	36	3	"high confidence" could be placed within parentheses at the end of this statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	Risk bullet points have been extensively modified.
684	83029	19	36	1	36	6	Line-of-sight cross-references are needed in support of these statements. (Katharine Mach, IPCC WGII TSU)	Risk bullet points have been extensively modified.
685	84391	19	36	1	36	6	This paragraph needs references to specific chapter sections (e.g., within chapters 8 and 24-26, based on information in Table 19-3). (Michael Mastrandrea, IPCC WGII TSU)	Specific cross references to sub-sections of our chapter are inserted and also references to other chapters are included in the Table 19-4 and CC-KR that matches the key risks outlined in the bullet points. Furthermore, we have also shown at the end how different key risks might be connected with the RFCs.
686	63727	19	36	4	36	6	Any reference? (GERMANY)	There are good references for this point, however, we modified the entire section and hence this is not anymore in the text.
687	83030	19	36	8	36	31	Cross-references to other chapters should ideally be at the level of specific chapter sections. Additionally, on line 11, it seems a number of regional chapters may be relevant? (Katharine Mach, IPCC WGII TSU)	The section has been modified, reference are shown to other parts of our chapter and in CC-KR to other chapters.
688	74204	19	36	17	36	17	It appears that a paragraph is missing here, linking to bullet 5 on Page 35 (risk in urban areas). (UNITED STATES OF AMERICA)	The entire section has been modified.
689	84392	19	36	24	36	31	Is there a reason why this key risk was not included in the ES? (Michael Mastrandrea, IPCC WGII TSU)	All key risks are now represented in the executive summary.
690	83031	19	36	34	0	0	Section 19.6.2.2. To what degree is it possible to integrate the focus of this section more into treatment across the chapter? (Katharine Mach, IPCC WGII TSU)	We considered this possibility but decided to retain this topic as a separate section since it is a key point that the chapter makes and that differentiates it from previous treatments of the topic.
691	83032	19	36	40	36	43	"high confidence" could be placed within parentheses at the end of the statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	Done.
692	63728	19	36	45	36	45	You should not rely on literature that has just been submitted, this is not scientifically sound. (GERMANY)	These citations have now been accepted before the IPCC WG2 deadline and so are allowable citations.
693	83033	19	36	49	36	51	What is the timeframe for this projection? Additionally, the range provided on line 50 could be clarified. (Katharine Mach, IPCC WGII TSU)	Text has been edited to include the time frame and clarify the meaning of the range.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
694	80572	19	37	37	37	38	I think the relative balance of climate change and land use change depends on the scenario. This statement may be true for unmitigated climate change with lower rates of land use change, but would it still hold for a lower climate change scenario with widespread increases in land use (eg: if bioenergy used as part of an "aggressive mitigation" strategy)? (Richard Betts, Met Office Hadley Centre)	Thank you, we agree, but we did not have space to expand on this point.
695	83034	19	37	37	37	38	The key findings of chapter 4 could be cross-referenced here. (Katharine Mach, IPCC WGII TSU)	The findings of chapter 4 are cross referenced extensively now in Ch 19.
696	57562	19	37	53	38	4	There should be rensonable and persuasive explanation why in Europe adaptation in the form of increasing dike heights is effective to reduce number of people affected by coastal flooding and adaptation in the form of dike is more difficult. (Mitsutsune Yamaguchi, The University of Tokyo)	The comment is not understandable and therefore could not be acted on.
697	77759	19	38	1	38	1	What are the units for the factors, and what types of uncertainties are represented by these ranges? (Francis Zwiers, Pacific Climate Impacts Consortium)	We have edited the text to use more understandable comparisons between scenarios and included the units (numbers of people, euros). We have also indicated that uncertainties depend on both the socioeconomic and sea level rise scenarios.
698	83035	19	38	1	38	2	It would be helpful to specify the scenarios of climate change and timeframe for this estimate. (Katharine Mach, IPCC WGII TSU)	We have edited to indicate that the time frame is 2100 and the results depend on socioeconomic and sea level rise scenarios (A2 and B1).
699	57835	19	38	18	0	0	I am not a fan of the burning embers diagram for several reasons. I recommend deleting it from the report. That said I assume the authors will kept it in the report. If so, there needs to be more discussion of how the authors quantify the risk for the different areas. The yellow-red boundary appears at different levels on each bar. To say that this is subjective judgment of the authors is not enough. In producing the figure, the authors have some value system-basis for the judgment in their heads in placing the yellow-red boundary. What is it? There needs to be an explicit discussion of the relative risks on this figure. Another issue is what factors are being assessed as drivers? Climate change alone or does population changes and other factors play a role? If so, these should be explicitly described in the text and figure caption. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2. In addition, we have emphasized in the text that the burning embers diagram assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk.
700	63078	19	38	18	0	0	Section 19.6.3. and Figure 19-5: First of all I ahve to say I like the figure as a vehicle to transmit complex risk issues to a wider public, so my below comments should not be understood as arguing against this figure. Nevertheless, some questions need to be addressed, and hopefully tackled. The term 'risk' has changed from TAR so Smith et al 2009, SREX and AR5. In AR5 (as stated in 19.6.3) vulnerabilities of societies and ecosystems are considered, and in a somewhat different way than in TAR. Section 19.6.3.1. quite nicely address this issue. I believe the figure in its original concept can still be applied/adapted, and this may be stated explicitly in the text. The figure has been and is the result of an expert assessment. It may not be feasible to describe the complete method how the figure has been constructed (especially coloring) but some more indications than in the current SOD version may be given, mainly to increase transparency and to reduce vulnerability to critique. (Christian Huggel, University of Zurich)	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2. In addition, we have emphasized in the text that the burning embers diagram assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk (whereas section 19.6.3.1, as the reviewer notes, addresses the cases of more optimistic or pessimistic development pathways).
701	67894	19	38	18	0	0	Section 19.6.3: The description in this section gives an impression there are no obvious difference from AR4, even as much more data collected for AR5 to increase confidence. However the impression of the figure is quite different because of the difference in format. Therefore, please describe more clearly that there were no obvious difference from the AR4 results including in the Executive Summary. The expression in the figure 19-5 can mislead the readers. (And please describe why the TAR and AR5 results are different) (JAPAN)	We have emphasized in the text (see paragraph 2 of section 19.6.3) a summary of differences in judgments relative to AR4. These judgments (and differences) are also highlighted in the assessment of each Reason for Concern.
702	83036	19	38	18	0	0	Section 19.6.3. For this section, the chapter team is strongly encouraged to consider the approach chapter 18 is taking, ensuring harmonized handoffs and approaches across the chapters. If harmonization is problematic, assessment of reasons for concern should occur in chapter 19, with cross-reference to chapter 18, but with no separate assessment of reasons for concern in chapter 18. (Katharine Mach, IPCC WGII TSU)	We now reference ch. 18 and use their judgments about current risks for RFCs explicitly in our judgments of the color of each burning ember at current global mean temperature.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
703	84393	19	38	18	0	0	Section 19.6.3: Please consider the approach taken by Chapter 18 in their SOD, and the desired coordination/handoff between the two chapters in this context. Should the evidence related to the observed component of each Reason for Concern and whether the transition to yellow occurs below or above "current" temperatures be discussed here or in Chapter 18? In addition, please specifically consider the described scope of aggregate impacts in Chapter 18 compared to that in 19.6.3.5. Chapter 18's discussion focuses on nonmonetary aggregations, while 19.6.3.5 focuses on monetary aggregations. (Michael Mastrandrea, IPCC WGII TSU)	We now reference ch. 18 and use their judgments about current risks for RFCs explicitly in our judgments of the color of each burning ember at current global mean temperature. Also, the discussion of aggregate economic impacts has been moved to section 10. We retain the component on ecosystem impacts and report only a summary of the ch 10 economic assessment.
704	83037	19	38	20	38	20	Would it be more accurate to call the reasons for concern " categories of risks, or characteristics of risks" also given the description in box 19-2? (Katharine Mach, IPCC WGII TSU)	We have retained our current language because titles of RFCs don't refer to risks, but to impacts that generate risks or systems that are at risk.
705	61500	19	38	20	38	30	The framework doesn't consider the rate of change, and obscures geographic variations. Other drawbacks of the framework are listed on p6 (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	These caveats are now explicitly acknowledged in the text.
706	83038	19	38	22	38	22	Given the risk framing should this be "individual potential consequences"? (Katharine Mach, IPCC WGII TSU)	Yes, we have made this edit.
707	60118	19	38	22	38	29	This sentence is too long and unclear. Suggest re-phrasing. (AUSTRALIA)	Typos in the original text led to a run-on sentence, this has been fixed.
708	57561	19	38	32	38	39	In updating Reasons for Concerns (RFCs), the text concludes that "levels of risk associated with extreme events, distributional impacts and large-scale singular events are similar (to that in AR4, added by the commentator) but can be assessed with higher confidence". However, when we compare RFCs in AR5 in respect of large-scale singular events with that of TAR, we immediately notice the big difference. For example, in TAR, colour never turns into red until 5 degree increase since 1990 whereas in AR5 (Figure 19-5), even at 4 degree increase from 1990 colour turns into red. This means RFCs have been changed between TAR and AR4. Actually, in page 38, line 46-47 in Chapter 19 of AR5, there is a description, citing AR4/WG2/Ch.19 and other literatures, that "An update based on literature assessed in AR4 concluded that the RFCs reflect more steeply increasing risk with global average temperature change in each category". And in AR4/WG2/Ch.19 (p.797), it is described as "There is medium confidence that at least partial deglaciation of the Greenland ice sheet, and possibly the WAIS, would occur over a period of time ranging from centuries to millennia for a global average temperature increase of 1-4 degree (relative to 1990-2000), causing a contribution to sea-level rise of 4-6 m or more (Section 19.3.5.2 ---)". Is the colouring of large-scale singular event in Figure 19-5 based on this description? (Mitsutsune Yamaguchi, The University of Tokyo)	We have rearranged the text to move the statement about the relative judgments about RFCs across TAR and AR4 to the beginning of 19.6.3, so that the summary of judgments that we make for AR5 can be easily put in this context by the reader. In addition, the risk for large scale singular events has now been described as higher (above 2 C) compared to the judgment in AR4.
709	84394	19	38	32	38	39	As mentioned in the context of the ES, this paragraph provides a good overview of what has and has not changed since AR4 the may be relevant for inclusion in the ES. (Michael Mastrandrea, IPCC WGII TSU)	In the ES, we decided not to emphasize changes in the RFCs since AR4.
710	58141	19	38	34	0	0	Why not also cite Kriegler et al alongside Smith? (Peter Good, UK Metoffice)	This text has been edited to be clear we mean only Smith et al 2009.
711	77760	19	38	34	38	34	What are distributional impacts? (Francis Zwiers, Pacific Climate Impacts Consortium)	We have edited the text to refer to "distribution of impacts" which is the same language used to describe this RFC in the previous paragraph. Hopefully this clarifies that we are referring to a particular RFC which is then explained in more detail in the sub-sections below.
712	66130	19	38	44	39	0	I suggest Fig 19.5 becomes 3 diagrams: 2001, 2009 and this diagrams all in one figure. This would allow visual comparison of the current with previous assessments (something which the text refers to). Mitigation lines could be removed from the 2009 figure. Overall, I think the RFC burning embers diagram has its problems, mainly because it is not strictly replicable by other scentists: there are no metrics against the copours (apart from their start and end points) and it is based on analysts' opinions. This may work where the analysts are the same (which they are in these 3 cases, which makes the figures more comparable than they otherwise might be), but where they are not it is not easy to see how the portrayed outcomes (the colour schemes) are comparable between one evaluation and another. More explanation of method might help to overcome these problems, ie more description of the method by which the analysts derived their opinions might make the diagrams more readily replicable by others and more transparent to the reader. (Martin Parry, Imperial College)	We carefully considered showing three versions of the burning embers diagram to allow for comparison, but decided against it due to space limitations. Also, we have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
713	83039	19	38	53	38	53	Would it be more accurate to say "systems exposed to climate change stresses"? (Katharine Mach, IPCC WGII TSU)	Yes, given that figure 19-1 is separating the ideas of vulnerability and exposure, we should distinguish the two ideas here. Done.
714	74205	19	39	10	39	12	The phrase "This figure does not address issues related to the rates of climate change or when impacts might be realized." needs to be copied into the figure caption . It is very important to understanding the figure. (UNITED STATES OF AMERICA)	Agreed, this edit has been made.
715	67895	19	39	10	39	14	Please explain why RFCs have not considered the time scale and pathway, despite AR4 did so. The time-scale and the pathways are very important factor for assessment of the risk as shown in Figure 19-6. Therefore, Figure 19-6 should be put together with Figure 19-5 in SPM and TS. Furthermore, a description that "Figure 19-5 does not consider the timescale and pathway" should also added for explanation (JAPAN)	We do not completely understand the comment, since AR4 did not consider explicitly consider time scales and pathways. We consider it implicitly, and have emphasized in the text that the burning embers diagram assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk.
716	57836	19	39	11	39	12	This phrase needs to be copied into the figure caption. It is very important to understand figure. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	This edit has been made.
717	61501	19	39	16	39	23	It is not clear from the legend whether the purple colour has been introduced to denote the uniquely high confidence associated with this RFC, or to denote the limited adaptive capacity of unique systems. If the latter, to what extent and how has adaptive capacity been figured into the consideration of the other RFCs? This isn't clear from the accompanying text (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We have clarified the criteria used to make these judgments in text added to the beginning of 19.6.3, which indicates that the purple color is based on very high risk levels including limited adaptive capacity, not on high confidence.
718	77761	19	39	23	39	23	Is the 2C rise measured against recent temperatures (e.g., late in the 20th century), or relative to preindustrial? This affects the interpetation of risk associated with 0 change on the vertical axis, and also affects the interpretation of the figure in the context of Article 2. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have clarified that this is 2 C relative to recent (1986-2005) temperatures.
719	77762	19	39	23	39	23	A further point of clarification is that the vertical axis presumably refers to transient warming (i.e., risk at the time at which the 1C, 2C, etc, thresholds are crossed), as opposed to risks that are associated with an equilibrium or stabilized warming of a given level. The long term risks associated with a stabilized climate that meets the 2C target may be different from the risks to which we are exposed at 2C when on an emissions pathway that eventually takes us past 2C - and those risks at 2C may also vary to some extent with the rate of temperature change at that time of threshold crossing (also indicating the dependence of risk on the emissions pathway). Thus to clarify, I think it might be helpful if the caption could say something about the assumed emissions pathway, and perhaps mention the possibility that there is could be some sensitivity to risk that depends upon the rate of climate change (and thus the emissions pathway) at the time of threshold crossing. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have added a description of sources of uncertainty in the color transition at the beginning of section 19.6.3, including the rate of change and time at which temperatures are reached.
720	80573	19	39	53	40	14	Cross-chapter discussion with Chapter 4 needed here - I am not sure that this is consistent at present. (Richard Betts, Met Office Hadley Centre)	Cross chapter discussion has occurred and this section has been completely rewritten so that is now mostly based on cross referencing the regional chapters in WGII and Ch 4 itself.
721	67896	19	40	1	40	20	Section 19.6.3. Please clearly show the base year... pre-industrialization or 1990. (JAPAN)	All base years have been clarified.
722	80574	19	40	4	40	7	Does this cover the full range of views in the literature? Other work (eg: Cox et al, 2013, Nature) suggests that tropical forests may be more resilient to climate change than previously thought, IF CO2 fertilization effects are strong enough (this is a key uncertainty). (Richard Betts, Met Office Hadley Centre)	We discuss risks to tropical forest elsewhere in the chapter, in particular relating to the recent literature concerning the Amazon. Here we focus on risks to tropical animals and specific types of forest and have reworded the text to clarify this.
723	67897	19	40	11	40	13	This expression should be unbiased considering there is a recently published nuanced review on Himalayan Glaciers. (T.Bolch, A. Kulkarni, A. Kaab, C. Huggel, F. Paul, J.G. Cogley, H. Frey, J. S. Kargel, K. Fujita, M. Scheel, S. Bajrachara, M. Stoffel., The state and Fate of Himalayan Glaciers, Science, 336(6079) 310-314 (2012). doi: 10.1126/science.1215828) (JAPAN)	Sentence added to reflect uncertainty in projections of Himalayan glacier melt and consequences thereof, citing the paper that the referee has provided, for which many thanks. The paragraph has been further edited to include a recent paper in Nature Geoscience on the same topic that you have highlighted.
724	83040	19	40	22	40	24	"high confidence" could be moved to the end of the sentence to maximize directness of wording. Additionally, in this paragraph and the subsequent paragraph, it would be preferable to make cross-references to working group 1 at the level of specific relevant chapter sections. (Katharine Mach, IPCC WGII TSU)	Statement edited and cross referenced as requested; also edited to reflect final WG1 draft

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
725	84395	19	40	22	40	24	Does this statement about the next 50 years imply the expectation of a 2C temperature rise by mid-century, per the first part of this sentence? It is unclear whether these are meant as separate or combined points. (Michael Mastrandrea, IPCC WGII TSU)	They were two separate statements, but the latest iteration of WG1 means that the wording needed to be subtly changed, we hope the new version is clearer.
726	74206	19	40	22	40	28	The statement “within the next 50 years” for a summer ice-free Arctic Ocean likely is outdated. (UNITED STATES OF AMERICA)	This paragraph has been edited to reflect edits made in the WGI part of the Assessment. The final statement made is taken directly from WG1 Ch 12, section 12.4.6.1
727	80575	19	40	24	40	24	The phrase "very distinct possibility" seems vague but emotive. Can a more objective likelihood statement be made? (Need to see what WG1 said in FGD). (Richard Betts, Met Office Hadley Centre)	The wording that you questioned was quoted directly from the WG1 SOD draft, but since this has now been changed, the phrase is no longer present.
728	57837	19	40	30	0	0	(AR5 SOD CH. 13) - What working group? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The quote referred to WGI as is now made clear.
729	57838	19	40	30	40	32	The time scale for the SLR is needed. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The text has been changed - time scale is no longer relevant.
730	77763	19	40	36	40	37	It is often said that the loss of glacial cover will affect downstream water supplies, but I think the effect is substantially more subtle than conveyed by this statement. The ultimate source of water is precipitation, and thus to first order, if precipitation (or more precisely, the balance between precipitation and evaporation) in the glaciated basin does not change (or perhaps increases) one would expect an unchanged or increased water supply assuming steady glacier mass balance. Chapter 18, section 18.3.1.3, has a nice explaination of the problem that they capture with the term "peak water". With warming, runoff exceeds that which would normally be expected to balance precipitation while the glacier is receding, up to a point where the production of melt water begins to decline. Passing this point of "peak water" comes to be perceived as a decline in water resources, but in reality, it could more appropriately be interpreted as a return to a sustainable level of water availablility (still assuming no change in precipitation). (Francis Zwiers, Pacific Climate Impacts Consortium)	We agree that the referee’s statement is correct. We have added a phrase to the end of the paragraph to reflect the point.
731	57839	19	40	48	0	0	increasing risk - What is the value/magnitude of the risk? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	it is not possible to quantify the risk. There is inevitably a certain amount of subjective judgrment in assigning impressions of risk from assessment of the literature, and classifying them into our colour bands. This is acknowledged in section 19.6.3.2 as well as in the related text in 19.3 and 19.4, as well as in chapter 18.
732	77764	19	40	48	40	52	Make sure that it is clear the temperature changes are deviations from some baseline (which I now gather is 1990-2000 rather than preindustrial). (Francis Zwiers, Pacific Climate Impacts Consortium)	We have carefully clarified the baseline in the Figure 19.5
733	57840	19	40	50	0	0	escalating risk - What is the value/magnitude of the risk? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	it is not possible to quantify the risk. There is inevitably a certain amount of subjective judgrment in assigning impressions of risk from assessment of the literature, and classifying them into our colour bands. This is acknowledged in section 19.6.3.2 as well as in the related text in 19.3 and 19.4, as well as in chapter 18.
734	84396	19	40	51	40	52	Does this mean high confidence that climate change impacts would outpace adaptation for many unique human systems and species within unique natural systems? Or does it mean species and systems more generally? I think the former, but it would be useful to be clearer given that it could be read to mean the latter. (Michael Mastrandrea, IPCC WGII TSU)	We have clarified that the statement refers to unique human and unique ecosystems.
735	84397	19	41	1	0	0	Section 19.6.3.3: This discussion should also address the fact that in WGI, confidence in observed changes in some types of extremes (e.g., drought) have gone down since AR4, while the likelihood of projected increases in others (e.g., heavy precipitation events) have gone up. All of this is relevant to the assessment of confidence in the risk from extreme events. (Michael Mastrandrea, IPCC WGII TSU)	We removed language on "small changes" in WGI uncertainty judgments relative to AR4 and instead emphasize (in the next paragraph) the WGI judgments across four different extremes which are particulary crucial in the chapter 19 assessment, and which range from very likely to medium confidence to low confidence.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
736	57649	19	41	1	41	1	Extreme events are not a reason for concern. Just read AR3. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	The executive summary of AR3 chapter 19 cites five reasons for concern, including the relationship between global mean temperature increase and the probability of extreme weather events". The title of 19.6.3.3 is a shortened version of this. The full defintion is given in 19.1.
737	80576	19	41	3	41	10	There may be a mixing-up of changing temperature extremes (due to shifting of mean of frequency distribution) with changes in extreme weather events. These are not necessarily the same thing. This part of the paragraph should be considered carefully for clarity. (Richard Betts, Met Office Hadley Centre)	The first two paragraphs of 19.6.3.3 now include statements from WGI specific to heat waves and warm spells.
738	80420	19	41	4	41	6	Please provide a specific reference to WGI, e.g. WGI Ch2. (Gian-Kasper Plattner, IPCC WGI TSU)	Done
739	83041	19	41	5	41	15	Cross-references to working group 1 should specify the specific relevant chapter sections. (Katharine Mach, IPCC WGII TSU)	Done
740	80421	19	41	10	41	10	It is not clear what the reference to "WGI SOD p. 10-3" means. Does it mean WGI Ch.10.3? Please clarify and uniform the reference style. (Gian-Kasper Plattner, IPCC WGI TSU)	Done
741	60119	19	41	12	41	20	The conclusions of the IPCC WG1 AR5 SOD stated between these lines should be presented more clearly to support the statement that this report increased confidence in risk assessment from extreme events made in the IPCC AR4. (AUSTRALIA)	We think that this is clear because as, noted, AR4 did not assess near term (~2035) climate changes, so confidence has increased by virtue of WGI making the statements.
742	80422	19	41	18	41	18	It is not clear what the reference to "WGI SOD p. 11-6" means. Does it mean WGI Ch.11.6? Please clarify and uniform the reference style. (Gian-Kasper Plattner, IPCC WGI TSU)	Citation updated and clarified
743	80577	19	41	20	41	21	I don't think there is increased confidence regarding all types of extreme events - for drought, confidence in SREX was lower than in AR4, and more recent work (eg: Sheffield et al, 2012, Nature; Betts et al, 2013, submitted to Biogeosciences) also suggests less of a risk of drought than in AR4). (Richard Betts, Met Office Hadley Centre)	We have recast the discussion to de-emphasize specific comparisons with AR4 and largley report AR5 outcomes, which are critical to this Chapter. Detailed comparisons with AR4 are available in the WGI report, would be too lengthy to report in any detail, and are not critical in assigning levels of risk here.
744	83042	19	41	20	41	21	Should a decreased level of confidence for assessment of some physical hazards in the context of extreme events be acknowledged here? (Katharine Mach, IPCC WGII TSU)	see response to comment 743
745	84398	19	41	21	41	24	The distribution of impacts will relate to vulnerability and exposure trends, not only to changes in physical hazards. Thus, it would be more logical to introduce this material after the next paragraph, discussing both physical and societal dimensions. (Michael Mastrandrea, IPCC WGII TSU)	These passages have been entirley rewritten which eliminates the problem noted by the reviewer.
746	80578	19	41	31	41	31	For an additional citation beyond SREX, consider McCarthy et al (2010, GRL). (Richard Betts, Met Office Hadley Centre)	Since there is an adequate SREX citation, we don't see the need to add more here.
747	80579	19	41	33	41	33	Including RCP2.6? (Richard Betts, Met Office Hadley Centre)	Sentence deleted.
748	80580	19	41	37	41	37	This seems weak as it appears to be merely a recycling of AR4. Is there no new evidence for this issue? (Richard Betts, Met Office Hadley Centre)	Sentence deleted.
749	79085	19	41	38	0	0	What does "category" refer to? Please move explanation from later in this paragraph to the first line. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	We are unable to find the passage referred to in this comment.
750	60120	19	41	40	41	45	Too long sentence, it is hard to comprehend, especially in relation to Figure 19-5. Suggest re-phrasing. (AUSTRALIA)	We have rewritten this sentence to increase clarity.
751	84400	19	41	40	41	49	It seems that understanding of existing vulnerability of exposed systems could also be mentioned to support the assignment of "yellow" to current temperatures as well here. (Michael Mastrandrea, IPCC WGII TSU)	Suggested edit made.
752	84399	19	41	41	41	41	For clarity, I would suggest changing this to read "attribution of changes in some (but not all) types of extreme events…" (Michael Mastrandrea, IPCC WGII TSU)	Rewritten section is much more specific so suggested change is not necessary.
753	83043	19	41	41	41	42	Should decreased confidence in some changes in some types of extreme events be acknowledged? (Katharine Mach, IPCC WGII TSU)	Since we now limit the application of the attribution criterion for assigning risk to a few very specific cases, we do not believe a discussion of non-attributed cases is warranted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
754	57841	19	41	44	0	0	Why is the yellow-red boundary placed at this level? What is the quantification of the risk? Compare this risk to that shown in the other bars. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	As pointed out in response to comments 752 and 753, the section has been rewritten so that the aplication of criteria here is now much more specific.
755	74207	19	41	44	41	49	This approach seems inconsistent with chapter 18, (which has low - medium confidence for attribution of most current extreme events) and largely based on one citation and the expert judgement of the authors. What is the quantification of the risk? Can it be expressed in confidence language? (UNITED STATES OF AMERICA)	As noted in response to comments 752-754, we have rewritten this section to refer only to attribution of specific types of extremes in determining the basis of our judgment. The langauge is now fully consistent with Chatper 18. in 19.6.3.3, we cite Chapter 18 directly when discussing the role of impacts attribution in our judgment and cite WGI when discussing atrribution of physical characteristics of extremes. The objective of the RFCs is to provide a relative and qualitative assessment of risk, not a quantification.
756	60121	19	41	45	41	49	This needs a better description of the relationships between physical and social factors and risks levels, as depicted in Figure 19-5. (AUSTRALIA)	We have rewritten this passaage based on additional information cited earlier in 19.6.3.3.
757	61502	19	42	12	42	14	This paragraph needs some evidential substantiation and references. Should the final clause read "of human systems"? (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This text has been deleted.
758	79123	19	42	16	0	0	A group of colleagues and I have publish in the journals Mitigation and Adaptation Strategies for Global Change (this 2013) and in Atmosfera (2011) two studies that evaluate the agricultural sector of Mexico. According to this paragraph starting in line 16 and our results, I put to your consideration to add Mexico as a country where crop yields are expected to decrease. The references are 1) Monterroso Rivas A.I., Conde Álvarez C., Gay García C., Gómez Díaz J.D., y López J. 2013. Two methods to assess vulnerability to climate change in the Mexican agricultural sector. Mitigation and Adaptation Strategies for Global Change. doi: 10.1007/s11027-012-9442-y, and 2) Monterroso Rivas A.I., C. Conde Álvarez, G. Rosales Dorantes, J. D. Gómez Díaz and C. Gay García. 2011. Assessing current and potential rainfed maize suitability under climate change scenarios in México. Atmósfera 24(1), 53-67 (Alejandro Monterroso, Universidad Autonoma Chapingo)	We have rewritten the paragraph concerning food security in collaboration with Ch 7, cross-referencing to Ch 7. We limit our discussion of regions affected to latitudinal bands without reference to any specific countries.
759	57769	19	42	16	42	18	these seem like weird references for these statements. I suggest looking at ch 7 and pulling a statement from there (David Lobell, Stanford University)	We have rewritten the paragraph such that the information is drawn from and cross references Chapter 7.
760	62719	19	42	16	42	23	Food security is complex, and is certainly different from the decrease in food production or in food productivity. There will be several possibility to define food security. Akimoto, K., Wada, K., Sano, F., Hayashi, A., Homma, T., Oda, J., Nagashima, M., Tokushige, K., Tomoda, T., Consistent assessments of pathways toward sustainable development and climate stabilization, Natural Resources Forum 36(4), 231-244 (2012) defines food security as the amount of food import per GDP and food access as the a m o u n t of food consumption per GDP. Then, the study shows the possibilities that deeper emission reductions rather worsen the food security and it is a different conclusion from the description of IPCC draft. Such a different analysis should also be referred and described with good balance. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	We have rewritten the paragraph concerning food security in collaboration with Ch 7, cross-referencing to Ch 7. The complex interactions between food security and mitigation that you mention are highlighted in section 19.4.1
761	67898	19	42	16	42	23	Section 19.3.4: There are various definitions of food security; therefore, criteria for assessment should be shown clearly. Here Akimoto et.al, (Akimoto, K., Wada, K., Sano, F., Hayashi, A., Homma, T., Oda, J., Nagashima, M., Tokushige, K., Tomoda, T., Consistent assessments of pathways toward sustainable development and climate stabilization, Natural Resources Forum 36(4), 231-244 (2012)) defined that food security as "Account Food import per GDP" (JAPAN)	We have rewritten the paragraphs relating to agriculture in collaboration with Ch 7 and use their definition of food security
762	57770	19	42	22	42	23	check this statement with the australia chapter (David Lobell, Stanford University)	We have rewritten the paragraph concerning food security in collaboration with Ch 7, cross-referencing to Ch 7. We limit our discussion of regions affected to latitudinal bands withour reference to any specific countries.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
763	57842	19	42	24	42	26	How is this variability different from temperature and precipitation variability? Should not the later be discussed too? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have rewritten the paragraph concerning food security in collaboration with Ch 7, cross-referencing to Ch 7. As a result the text relating to this comment has been deleted.
764	84402	19	42	28	42	32	This paragraph could be better suited in the next section on aggregate impacts, as it discusses impacts on species extensively. (Michael Mastrandrea, IPCC WGII TSU)	We have revised this paragraph to focus on the distribution of the projected impacts on species, whereas in the next section the focus is on aggregate global impacts
765	84401	19	42	29	42	29	Please clarify what is meant by "at risk" here--of extinction, for example? (Michael Mastrandrea, IPCC WGII TSU)	We refer to the risks of local extinction of plants and animals.
766	57771	19	42	34	42	43	again I find this section lacking in confidence statements which make it hard to know how much evidence these statements are based on (David Lobell, Stanford University)	We have rewritten these statements in collaboration with Ch 7 and used confidence statements consistent with this.
767	83044	19	42	42	42	42	The reference to chapter 2 should be clarified--working group 1? (Katharine Mach, IPCC WGII TSU)	We have corrected the cross references
768	84403	19	42	42	42	42	The reference to Chapter 2 here seems to be an error--is Chapter 18 intended? (Michael Mastrandrea, IPCC WGII TSU)	We have corrected the cross references
769	57843	19	42	43	0	0	Why is the yellow-red boundary placed at this level? What is the quantification of the risk? Compare this risk (placement of the red-yellow boundary) to that shown in the other bars. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We have justified the placement of the yellow-red boundary in the text, discussing its link with impacts on regional crop production and water resources.
770	63079	19	42	46	0	0	19.6.3.5: I liked the section on aggregate impacts because it widens the perspective of purely economic and integrated assessment model driven approaches to other aspects (e.g. ecosystems) and states limitations to (traditional) IAM's. In chapter 18 we had some discussions about possible metrics for aggregate impacts. % of GDP and other monetary units, as well as SCC are most widely used in this context. People affected or killed could be another measure but I believe there is not much in the literature. The section is quite long, and there may be some potential for reducing text although I could not find any obvious redundancies. (Christian Huggel, University of Zurich)	The primary assessment of aggregate economic impacts has been moved to Ch. 10 which has helped reduce length. We retain a summary of that assessment and interpretation in terms of RFCs.
771	83045	19	42	46	0	0	Section 19.6.3.5. The approach taken in chapter 18 should be considered, with more deliberate harmonization across the chapters. (Katharine Mach, IPCC WGII TSU)	We have explicitly harmonized with Ch 18 by adopting their assessment of detection and attribution of aggregate impacts in locating our transition from neutral to moderate risk.
772	61503	19	42	46	45	27	The discussion of the Aggregate Impacts RFC foregrounds losses to biodiversity and ecosystem services much more than the TAR and AR4 discussions, which seemed to place a greater emphasis on monetary impacts. While this is to be welcomed, it does the raise the question of whether the Aggregate Impacts category hangs together. Given the great uncertainties which are outlined, the acknowledged masking of regional disparities, and the unmentioned tacit assumption that positives and negatives cancel each other out (as mentioned in the TAR), it seems right to question whether such a diversity of metrics can be combined into an informative category. Would the RFCs construct not be strengthened by perhaps disaggregating monetary losses and losses to biodiversity for example? Although that would raise a tricky question of how to account for ecosystem services, it might result in a more usefully informative picture of how different aggregated impacts change with rising temperatures, allowing communication both of the "severe" impacts on ecosystems, and the more circumspect account of economic and sectoral impacts. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We carefully considered the possibility of separately representing aggregate impacts to economies and to ecosystems, but decided to keep the current approach despite its limitations. Different aggregate impacts are assessed separately in the text and we explain which ones motivate the location of risk transitions in the burning embers diagram.
773	57650	19	42	46	45	30	The opening paragraphs of 19.6.3.5 are not about aggregate impacts at all. These are followed by paragraphs stating that you really should not trust these studies. This is most odd. You do not write in the same way about other literatures, even if those papers can be picked apart just as easily or even more so. It is your job to assess the literature, rather than attack it. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This part of section moved to Ch. 10. Section completely rewritten.
774	62720	19	43	1	43	7	Akimoto, K. et al., Natural Resources Forum 36(4), 231-244 (2012) estimates global warming damages based on the functions developed by Nordhaus. The estimated global warming damages in 2100 for 4.1 degrees C (baseline, 2.8 degrees C, and 1.9 degrees C increase are 3.1%, 1.6%, and 0.8%, respectively. The estimates should be referred. Particularly the damage in the case of 1.9 degrees C (nearly 2 degree) increase should be described. The substitutions of damages are the most important for considering the benefit of reducing emissions. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	This part of section moved to Ch. 10. Because the paper cited by the reviewer does not provide an original estimate it has not been included.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
775	83046	19	43	2	43	3	"high confidence" could be placed within parentheses at the end of the statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	This part of section moved to Ch. 10. Confidence assessments dropped in line with style adopted by Chapter 10.
776	77765	19	43	6	43	6	What are the uncertainties on these estimates? (Francis Zwiers, Pacific Climate Impacts Consortium)	This part of section moved to Ch. 10. Estimates dropped.
777	83047	19	43	9	43	9	"medium confidence" should be italicized for clarity. (Katharine Mach, IPCC WGII TSU)	This part of section moved to Ch. 10. Confidence assessments dropped in line with style adopted by Chapter 10.
778	84404	19	43	9	43	22	Please consider the discussion in Chapter 4 of these issues and the evaluation of the AR4 conclusion relevant to extinction risk. (Michael Mastrandrea, IPCC WGII TSU)	Explicit reference to ch 4 is now made.
779	63729	19	43	9	43	32	Here you write about biodiversity and species extinction - again. You already dealt with that topic in 19.3.2.1, 19.4.3.1, and 19.6.3.2. Bring these pieces together and make it one comprehensive section. (GERMANY)	We have retained but shortened the discussion here to avoid repetition but to allow for interpreting these impacts in terms of RFCs and the burning embers diagram.
780	83048	19	43	9	43	38	These paragraphs should be coordinated with chapters 4 and 6, ensuring harmonized assessment and appropriate cross-referencing. (Katharine Mach, IPCC WGII TSU)	Explicit reference to ch 4 and ch 6 is now made.
781	77766	19	43	21	43	22	The statement here, that the AR4 assessment still stands, seems to be somewhat equivocal to me. We seem to have much more information, but the confidence level and the estimate of the number of species at risk seems to be about the same. Some discussion of why the more substantial literature does not allow an assessement with greater confidence would be appropriate. (Francis Zwiers, Pacific Climate Impacts Consortium)	This text has been revised following discussions with Ch 4
782	80581	19	43	21	43	22	The status of the AR4 statement relating to extinction risk should be discussed with chapters 4 and 5. The chapter 4 SOD Exec Summary has a carefully-considered statement which is less quantitative than the AR4 statement. (Richard Betts, Met Office Hadley Centre)	This text has been revised following discussions with Ch 4
783	80582	19	43	24	43	32	This paragraph appears to be more relevant to the Detection and Attribution chapter (Richard Betts, Met Office Hadley Centre)	This text has been deleted.
784	83049	19	43	44	43	45	Are these costs in 2100? (Katharine Mach, IPCC WGII TSU)	This text has been deleted.
785	77767	19	43	45	43	48	I think this needs careful assessment in light of the current SREX and WG1 AR5 assessments of projections of changes in tropical cyclone frequency and intensity. Those assessments have changed since the AR4. (Francis Zwiers, Pacific Climate Impacts Consortium)	This text has been deleted.
786	84405	19	43	51	43	54	I would suggest characterizing these aggregate and sectoral estimates in terms of their "consistency" as formulated currently, which is a part of the evaluation of evidence as suggested in the guidance on treatment of uncertainties. It appears that in this case estimates are not consistent and that the broader evaluation of evidence leads to an assessment of "low agreement" by the author team, with the consistency of lines of evidence a key element (but also evaluation of the quality of the various lines, etc.). (Michael Mastrandrea, IPCC WGII TSU)	This part of section moved to Ch. 10. Confidence assessments dropped in line with style adopted by Chapter 10.
787	83050	19	44	1	44	3	"very high confidence" could be placed within parentheses to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	This part of section moved to Ch. 10. Confidence assessments dropped in line with style adopted by Chapter 10.
788	57651	19	44	20	44	20	Fig 19-8 does not show what you claim it shows. DICE has no sectoral disaggregation. ENVISAGE is a general equilibrium model while FUND is enumerative: Sectors are thus defined differently, and impact on sector is measured differently. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	Figure dropped
789	80583	19	44	25	0	0	What are the "expected catastrophic damages"? (Richard Betts, Met Office Hadley Centre)	This part of section moved to Ch. 10. Language dropped.
790	77768	19	44	30	44	35	Marathon run-on sentence! (Francis Zwiers, Pacific Climate Impacts Consortium)	This part of section moved to Ch. 10. Rephrased.
791	79988	19	44	34	44	35	Please consider reflecting this finding also in the TS and possibly in SPM. (NORWAY)	This part of section moved to Ch. 10. Point dropped as not supported by literature.
792	83051	19	44	38	44	39	"high confidence" could be placed within parentheses to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	This part of section moved to Ch. 10. Confidence assessments dropped in line with style adopted by Chapter 10.
793	77769	19	44	45	44	45	What does the range of decreases represent? Uncertainties in the analysis, or differences between countries, or both? (Francis Zwiers, Pacific Climate Impacts Consortium)	This part of section moved to Ch. 10. Language dropped as discussed elsewhere.
794	57652	19	44	49	44	50	This claim was made in the working paper version of Dell et al., but dropped in the journal version -- because it does not follow. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This part of section moved to Ch. 10. Language dropped.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
795	61504	19	45	2	0	0	19.7.2.2. This could be clearer about whether the human health impacts referred to occur at these temperature increases at a local scale or as global mean temperature change. To refer to 'global warming of 7C' seems imprecise. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Line numbers are incorrect, not clear what this comment refers to.
796	57653	19	45	26	45	27	AR3 and AR4 contradict each other, so you cannot be similar to both. It is weird that with so many new studies published, you claim that our confidence is unchanged (from whatever position). Our understanding of the structure of the uncertainty has definitely increased since AR4. We now have a much better understanding of what assumption is important (or not). We have also learned that focussing on the headline number, as you do here, is not informative. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	This part of section moved to Ch. 10. Language dropped.
797	80584	19	45	30	45	38	A further useful paper for section 19.6.3.6 may be McNeall et al, 2011, 'Analysing abrupt and non-linear climate changes and their impacts', WIRES Climate Change (Richard Betts, Met Office Hadley Centre)	Reference added.
798	58142	19	45	30	46	38	My main concern for this section is that it is maintained consistent with the detail in the rest of AR5. There are lots of references to other parts of AR5. it may happen that relevant material is altered in response to review comment else where, and the relevance not picked up in chapter 19. It may be the case that expert reviewers of the individual systems do not go into this specific but important section. Hopefully this section will be revisited by relevant chapter authors _after_ they have revised their own detailed chapter. (Peter Good, UK Metoffice)	We have continually updated this section to account for the final drafts.
799	60122	19	45	38	45	53	Although a solid volume of literature is reviewed in relation to ice melt, it may be useful to include more recent analyses. (AUSTRALIA)	The citations are recent and we also cross-checked with the WGI assessment.
800	61505	19	45	38	45	53	The authors may want to consider the recent Bamber & Aspinall paper in Nature Climate Change doi:10.1038/nclimate1778 (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Bamber and Aspinall provides a probability distribution for sea level rise from continuous ice loss by 2100, and does not really address the issue of a singular event.
801	57724	19	45	40	0	0	Suggest changing to "….centuries to millennia following a sustained global average temperature increase of 1-4°C…" As the dynamic response time of ice sheets is not instantaneous. (Jeff Ridley, UK Met Office)	This section is a close excerpt from AR4 and so cannot be reworded.
802	57725	19	45	42	45	43	Remove this sentence as it is not relevant to the subject of thresholds or future sea level rise it is merely an observation of current state - "At the current time, the Greenland ice sheet is making about twice the contribution to sea level rise as the Antarctic ice sheet (Shepherd et al., 2013)." (Jeff Ridley, UK Met Office)	We disagree. This sentence provides context.
803	67899	19	45	42	45	43	It would be better to show which part is caused by the global warming, and which part is caused by other reasons including pesticides, land-use change, water pollution, and so on. (JAPAN)	We don't understand the relevance of this comment.
804	57726	19	45	44	45	45	Why is this important? At best it is only a partial analog and why does it matter what the distribution of the source of freshwater is. One would need to bring in the effect of the redistribution of mass and spatial pattern of sea level rise for this to be relevant. In anycase we are still talking of millenial timescales. (Jeff Ridley, UK Met Office)	We use the LIG because WGI uses it as an analog. While the information about relative conribution is not critical to our assessment, it provides relevant information with respect to assessing the future risk of a singular event involving one or the other ice sheet.
805	57727	19	45	50	0	0	"...remains contested" This is not the case. All references quoted suggest intermediate states in which partial rather than complete melt may be attained. The ice sheet loss reversibility is very long timescale and would clearly be reversed by the next ice age. Need to clarify why reversibility is important - some of the sea level rise is reversible Rate of loss of Greenland ice sheet depends on magnitude and duration of elevated temperatures. Need to re-emphasise the millenia timescales. (Jeff Ridley, UK Met Office)	Reversibility discussion has been eliminated.
806	57728	19	45	52	45	53	It is no longer the issue that the representation of ice sheet dynamics is the hinderence (Drouet, A. S., Docquier, D., Durand, G., Hindmarsh, R., Pattyn, F., Gagliardini, O., and Zwinger, T.: Grounding line transient response in marine ice sheet models, The Cryosphere, 7, 395-406, doi:10.5194/tc-7-395-2013, 2013.), it is the lack of any coupled climate-icesheet simulations and the poor simulation of southern ocean characteristics. (Jeff Ridley, UK Met Office)	We disagree in part. Progress on modeling grounding lines only resolves part of the question of dynamics. Much else remains to be appropriately modelled. We have added wording on ocean processes.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
807	58143	19	46	4	0	9	This needs to be more precise and clearer on what we do and don't know. See abstract of the review by O'Connor et al. 2010. I suggest: "Feedback processes in the Earth system _could_ cause accelerated emissions of methane from wetlands, permafrost and ocean hydrates. There are large uncertainties in the size of carbon stores, the timescales of release and the fate of the carbon once released. However, the risk of substantial carbon release increases with warming, and very large emissions (potentially comparable to anthropogenic emissions over century timescales) cannot be ruled out. (Peter Good, UK Metoffice)	Most of the suggested wording has been adopted, together with a quote of the WGI conclusion.
808	69867	19	46	5	46	5	Additional emissions from terrestrial permafrost and marine hydrates as a result of warming may not necessarily be in the form of methane only. Carbon dioxide may also be released. (Fiona O\\\'Connor, Met Office)	Potential role of CO2 has been added to text.
809	69868	19	46	5	46	5	Some clear indication of the timescales associated with the response of wetlands, permafrost, and marine hydrates to temperature increases would be useful. See O'Connor et al. (2010). (Fiona O\\\'Connor, Met Office)	This section is aimed at tipping points, not at gradual release, so we don't think that detailed information on timescales is pertinent here. However, we do mention the WGI summary on the timescale point.
810	69869	19	46	7	46	10	This sentence seems awkward, is trying to encompass too much information (including timescales), and as a result, is not very clear. How about "Model results indicatate that on a century timescale, the additional cumulative emissions from these sources may become larger than those from direct cumulative anthropogenic emissions. A sudden large release from these sources could potentially occur, but on the timescale of millenia. " (Fiona O\\\'Connor, Met Office)	see response to comment 809. In any event, this passage has been deleted.
811	80585	19	46	12	0	0	"disappears" - why present tense? (Richard Betts, Met Office Hadley Centre)	we use present tense because the projections referred to are current projections even if they describe the future.
812	58144	19	46	14	0	0	why do you use the word 'eventually' in the phrase 'will eventually lead to' ? Surely sea ice responds rapidly to warming. (Peter Good, UK Metoffice)	Section rewritten to accord with WGI final draft.
813	58145	19	46	14	0	0	There is no citation for this sentence. At least refer to the appropriate part of AR5 (Peter Good, UK Metoffice)	Rewritten text has appropriate citations.
814	57844	19	46	15	0	0	very distinct possibility - What is the assessed likelihood? Dependence on RCP? (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Rewritten text uses WGI uncertainty language.
815	57729	19	46	17	0	0	This statement would require a reference - I am aware of none. A potential impact of sea ice decline is an increase in ocean acidification (Title: Impact of rapid sea-ice reduction in the Arctic Ocean on the rate of ocean acidification Author(s): Yamamoto, A.; Kawamiya, M.; Ishida, A.; et al. Source: BIOGEOSCIENCES Volume: 9 Issue: 6 Pages: 2365-2375 DOI: 10.5194/bg-9-2365-2012 Published: 2012) (Jeff Ridley, UK Met Office)	The statement on reversibility is merely for the purposes of noting that biological systems may not exhibit the same reversibility as the physcial systems driving them. It is a general point that needs no citation.
816	58146	19	46	19	0	21	The Kriegler study was based on an expert elicitation that took place around 2006 (i.e. corresponds to physical understanding circa AR4, even though the analysis and publication took some time). (Peter Good, UK Metoffice)	The reference is still informative due to lack of later literature using similar methods.
817	74208	19	46	19	46	23	Is is possible to add a second reference here, to provide another example of the uncertainty in projections around the AMOC? (UNITED STATES OF AMERICA)	See response to comment 817.The fact that we cite the WGI assessment as well should be sufficient.
818	80586	19	46	20	46	20	I think expert elicitations would "suggest" rather than "find" this -it is only opinion, not a physical experiment. (Richard Betts, Met Office Hadley Centre)	We disagree. The information given is indeed a "finding" of that particular study.
819	58147	19	46	25	0	0	There are no reference details for Adams et al. 2009 in the reference list. This is very disappointing for a second order draft. (Peter Good, UK Metoffice)	Thank you for pointing this out - the references have been completed for the FGD.
820	58148	19	46	25	0	0	Phillips et al. (2009) should be cited for confirming sensitivity to drought (Phillips et al., Science 323 (5919): 1344-1347) (Peter Good, UK Metoffice)	References inadvertently omitted. If relevant, will be added before final publication.
821	57845	19	46	25	46	29	This discussion misses the very large uncertainty associated with CO2 fertilization (particularly in the tropics) and the Amazon climate-ecosystem changes. Rewrite. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	We do mention the potentially large role of carbon fertilization and now have added the word "uncertain" to accommodate the comment.
822	58149	19	46	26	0	25	The transition is not necessarily to grassland. Malhi (2009) suggested transition to seasonal forest. (Peter Good, UK Metoffice)	Correction made.
823	83052	19	46	26	46	27	The corresponding key finding in chapter 4 should be cross-referenced. (Katharine Mach, IPCC WGII TSU)	Citation added.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
824	58150	19	46	27	0	29	The sentence starting 'Once recent study..' needs to match the equivalent statement in Box 4-3 of chapter 4, WGII. I have suggested edits to this part of chapter 4, so I think it best if your section (19.6.3.6) is revised _after_ chapter 4 is revised. In any case, this statement should not be based solely on Cox et al. (2013), whose observable constraint is stated to be more sensitive to soil (heterotrophic) respiration than vegetation properties (i.e. not necessarily relevant to forest dieback). (Peter Good, UK Metoffice)	We rewrote this section extensively with input from various WGI and WGII chapters. We believe it now reflects the state of the literature. The connection to CO2 fertilization is via water use efficiency.
825	58151	19	46	37	0	38	we judge that the _overall_ risk..' (Peter Good, UK Metoffice)	Suggestion adopted.
826	59739	19	46	37	46	38	A proposed slight modification in the conclusion about the likelihood of large-scale singular events. The conclusion on line 46 refers to the Greenland Ice Sheet (19.6.3.6). As explained in a comment on the overall WGII report, Section 19.6.3.6 refers to not only to the Greenland Ice Sheet, but also to the Antarctic Ice Sheet (page 45, line 43), and to only the western portion of the Antarctic Ice Sheet (i.e., the West Antarctic Ice Sheet or WAIS) on the West Antarctic Peninsula (i.e., the WAP) (page 45, line 39). The WGI report on driving forces describes record-setting changes in the Greenland Ice Sheet, but only minor changes in the huge East Antarctic Ice Sheet. So, I suggest that the AR5 conclusion about consistency with AR4 should refer to the "East Antarctic Ice Sheet" rather than to the "Greenland Ice Sheet." Specifically, I suggest the following conclusion for Chapter 19, Section 19.6.3.6, page 46, lines 37-38: Based on the weight of the above evidence, we judge that the risk from large-scale singular events, such as large-scale irreversible deglaciation, of the East Antarctica Ice Sheet, remains comparable to that assessed in AR4, as indicated by Smith et al. (2009) and Figure 19-5) (Thomas Dunning Newbury, U.S. Department of the Interior (retired))	See response to comment 5. We think this interpretation of the information on ice sheets is incorrect.
827	77770	19	46	43	46	43	Suggest replacing "likelihood" with "magnitude". Mitigation may reduce the likelihood of some irreversible (or potentially irreversible) changes, but I think it is a certainty that mitigation would reduce the magnitude and rate of change of climate change. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have retained the current wording in order to recognize that mitigation can only change the likelihoods of experiencing particular rates and levels of climate change, given uncertainties in the climate response to emissions (and to emissions reductions).
828	63730	19	47	1	0	0	This section should not be discussed here, a similar section can be found in ch. 2, where it fits much better. Avoid repetitions. (GERMANY)	The section in chapter 2 discusses only adaptation and mitigation tradeoffs in general terms. This section specifically addresses quantitative relationships between mitigation, adaptation and residual impacts.
829	78898	19	47	1	0	0	The authors might consider whether the Garnaut Report in Australia is also useful here, since it provided a national estimate of economic costs under mitigation and non-mitigation scenarios (see Chapter 25). My main concern with this section is that it does not synthesise evidence from the sectoral and regional chapters of WGII, which makes the evidence base that is cited much thinner than it really is. But I understand that only so much is humanly possible to do by the authors... (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	Information about economic costs was not included because of space constraints and because it was agreed that chapter 20 would cover this aspect.
830	83053	19	47	17	47	19	Given the scope of this statement, presumably other citations or line-of-sight references are needed. (Katharine Mach, IPCC WGII TSU)	See response to comments 831 & 832 – the statements on acidification are now cross referenced to Ch 30 and on temperature to WGI Ch 12.
831	77771	19	47	21	47	24	See also WG1, Chapter 12, which assesses the literature on the potential irreversibility of warming on human time scales. (Francis Zwiers, Pacific Climate Impacts Consortium)	Thank you – very helpful, but this sentence has been deleted.
832	57846	19	47	24	47	26	The time scales for ocean acidification and ocean temperature response seem very complex to me. It is unclear to me if only the ocean surface is in view or some volume mean….surface I assume. I think the past trajectory of CO2 increase matters for this statement. Either add much more or delete. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	Thank you, very helpful: the text has been amended and is now consistent with, and cross references, FAQ30.1 relating to ocean acidification responses.
833	77772	19	47	29	47	29	Is Warren et al (in press) the same paper as Warren et al (2012), cited on line 40? (Francis Zwiers, Pacific Climate Impacts Consortium)	Citations have been updated now that papers are published.
834	77773	19	47	52	48	12	I'm wondering if some of this would not be more appropriate for WG3? (Francis Zwiers, Pacific Climate Impacts Consortium)	We have discussed with WGIII to reduce overlap. Some intentional overlap remains as we believe this information is important for both WGs
835	80587	19	47	53	0	0	I think "suggested" rather than "showed" would be more appropriate here - these are modelling studies, not experiments. (Richard Betts, Met Office Hadley Centre)	This sentence has been revised and the comment is no longer relevant.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
836	83054	19	48	18	48	21	Should the rate of emissions reduction be specified? (Katharine Mach, IPCC WGII TSU)	The rate of emission reduction is not specified in the cited reference, but rather the authors compare 800ppm with 500ppm worlds, which is now detailed in this sentence.
837	84406	19	48	18	48	21	In this description, it is not clear what level of mitigation is occurring (e.g., by what amount are emissions reduced compared to the baseline)? (Michael Mastrandrea, IPCC WGII TSU)	Please see response to comment #836.
838	61506	19	48	21	48	26	The sentence including "mitigation was found to reduce…welfare losses…with losses in the agricultural sector changing to gains" needs substantiation, particularly regarding which mitigation scenario is referred to, and the magnitude of the agricultural shift. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	This sentence has been deleted.
839	83055	19	48	23	48	25	What is the relevant time frame for this projection, and should the rate of emissions reduction be specified? (Katharine Mach, IPCC WGII TSU)	This sentence has been deleted.
840	84407	19	48	25	48	25	For 318-396,000 and 251-276,000, it is not clear whether the first numbers are "318" and "251" or "318,000" and "251,000." I assume the latter, but for clarity please specify. (Michael Mastrandrea, IPCC WGII TSU)	The detail was removed to save space and because closer examination of the numbers reveal them to be confusing and unclear in the literature cited
841	80588	19	48	26	48	26	I thiink "suggested" or "projected" would be better here, as these are only modelling studies. (Richard Betts, Met Office Hadley Centre)	Wording change inadvertently omitted. Text will be changed accordingly for final publication.
842	83056	19	48	38	48	44	This approach is encouraged, with clear and specific line-of-sight provided to assessment findings across the working groups. (Katharine Mach, IPCC WGII TSU)	We have coordinated closely with WGIII to finalise this text. WGIII has been coordinating closely with WGI in relation to the same text.
843	77774	19	48	38	48	50	Obviously still incomplete - which is worrisome at the SOD stage. (Francis Zwiers, Pacific Climate Impacts Consortium)	We agree, and have completed this carefully.
844	80423	19	49	1	49	40	Section 19.7.2: Refer to WGI Ch12 for the allowable emissions and climate target discussion. (Gian-Kasper Plattner, IPCC WGI TSU)	We have added reference to WG1 Ch12.5.4 for the relationship (and its uncertainty) between emissions and long-term climate stabilization.
845	77775	19	49	6	49	10	See also WG1, Chapter 12, which assesses the likelihood that warming can be limited to less than 2C relative to preindustrial under RCP2.6 (their assessment in the SOD was "about as likely as not", consistent with the 50% chance reported here. Also, WG1 Chapter 12 assesses implied emissions that are consistent with RCP2.6 based on the complex earth system models participating in CMIP5, as well as total cummulative emissions that would be consistent with the 2C target. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have added reference to WG1 Ch12.5.4 for the relationship (and its uncertainty) between emissions and long-term climate stabilization. We have also referred to the fact that RCP2.6 is itself evidence of a feasible scenario for stabilizing at 2 C (as concluded in 12.4.1.1 it is unlikely to lead to more than 2 C).
846	61507	19	49	18	49	33	A corollary of the arguments about the policy assumptions embedded in integrated assessment analyses of mitigation strategies, particullarly the assumption of universal participation and optimal implementation, is the point that IA is unable to account for the economic advantages and political effects of, for example, a large developed nation taking a lead on mitigation. The potential knock-on benefits of policy leadership are not (probably cannot) be functioned into the conventional cost-benefit style analyise which still direct much policy thinking - the models therefore in a sense help create the world in the image of the models' own conceptual frameworks. This is the argument put forward by Doug Kysar in 'Regulating from Nowhere' (2010). (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	no response necessary
847	62727	19	49	23	49	25	The two pathways of 450 ppm CO2eq in 2100 and 450 ppm CO2eq stabilization are very different. The description of "roughly consistent with a 50% chance of remaining below 2 ºC" must be for 450 ppm CO2eq stabilization. Therefore, "stabilization" should be added. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	We have added text to indicate not exceeding 450 CO2eq.
848	67900	19	49	23	49	25	450 ppm CO2 eq in 2100 and 450ppm CO2 eq stabilization is quite different. As the current case is 450 ppm CO2eq "stabilization" scenario, please describe "stabilization" for clarification. (JAPAN)	We have added text to indicate not exceeding 450 CO2eq.
849	79989	19	49	26	49	26	“Unless a temporary overshoot of these targets were allowed.” It is hard to understand the relevance of this sentence. Due to the fact that the climate targets are linked to the stabilized GHG concentration in the atmosphere (as stated in article 2 in the (NORWAY)	Many scenarios in the literature allow for overshoot of targets, and this sentence refers to such studies.
850	57847	19	49	43	50	43	For SLR and ice sheet response, the time scale of the response needs discussed explicitly…and added to the discussion found in this section. (Ronald Stouffer, Geophysical Fluid Dynamics Laboratory/NOAA)	The text now mentions the wide range of time scales and refers to text in this chapter, in key sections of the WGI report, and a key paper. While a much more careful discussion would be helpful, it is not possible given space constraints.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
851	80424	19	49	43	50	43	Section 19.7.3: Only one reference to the WGI AR5 SPM. Please cross-reference WGI AR5 more thoroughly given the importance and overlap of this topic. Large parts of this section are providing an assessment of what builds an integral part of the WGI physical science basis assessment provided in WGI AR5 Ch12. Yet this Chapter is not even referred to. Suggest to revise and to update the discussion referring to Ch12 WGI AR5 and ensuring consistency between WGs I and II AR5. Avoid overlaps in the assessment. (Gian-Kasper Plattner, IPCC WGI TSU)	The text now contains more references to WGI.
852	66311	19	49	43	51	33	Would it be helpful to include a global map or table showing levels/ranges of warming representing potential system thresholds and/or irreversibilities? This could take the form of something similar to the Lenton et al. maps that have appeared in the literature in recent years. Perhaps some combination of that idea with the hot spot map in Figure 19-2 could be thought about. In any case, the burning embers is not really sifficient as a source for picking off temperature thresholds; nor are the IAM results. There seems to be no lack of robust evidence emerging (with uncertainty ranges) giving magnitudes and rates of change that might approach or exceeding critical thresholds of response. I was missing some more explicit illustration of these here. (Timothy Carter, Finnish Environment Institute)	Such a summary would indeed be very helpful, but space constraints do not allow for adding it. The text does cite several peer reviewed studies that have such figures and tables.
853	79990	19	49	52	49	52	Please add "stabilized" to generate: “levels of stabilized greenhouse gas concentrations” (NORWAY)	"Stabilized" is indeed a common assumption in this kind of analysis. However, it is not an assumption shared by all studies in the literature. The text now includes one reference that is one of these exceptions. The suggested text revision is hence at odds with the body of the reviewed literature and is not adopted.
854	60123	19	49	53	9	53	This statement is not true for Australia. Australia has a formalised inter-jurisdictional governance structure through the Council of Australian Governments (COAG) (http://www.coag.gov.au/). While at this stage there is no national adaptation planning framework, there are nationally agreed priorities for adaptation with an agreed coastal adaptation work plan under way as well as agreed roles of responsibilities of levels of government (http://www.climatechange.gov.au/government/initiatives/sccc/meetings.aspx). Recommend not citing a master's thesis for this material. Best to ask relevant government agencies to provide published evidence. The role of COAG is detailed at http://www.climatechange.gov.au/government/initiatives/sccc/meetings.aspx (AUSTRALIA)	The line numbers for this comment are not accurate. It is unclear what it refers to. No action taken.
855	61508	19	50	1	0	0	19.7.5. The section seems quite oriented to the concerns of developing countries. Developed countries will also face governance challenges of a kind recognised in other chapters with reference to work by e.g. Biesbroek et al. The chapter has earlier discussed the emergent risk of temperature increases above 4C. This would imply the need to engage in more 'transformative' forms of adaptation. However, the kind of decision-making and governance processes for deciding where such transformation is necessary and how to bring it about in legitimate and effective ways remain relatively unexamined. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The line numbers for this comment are not accurate. It does not appear to refer to the version of 19.7.5 in the SOD. No action taken.
856	83057	19	50	3	50	3	What year is relevant to the "present values" mentioned here? (Katharine Mach, IPCC WGII TSU)	The text now provides the time-window specified in Lenton et al (2008).
857	61509	19	50	16	0	0	This paragraph relates to what Neil Adger refers to as implicit social contracts between state and society, by which various responsibilities are asigned. He also notes how these can change after extreme events (although this may not be discussed in a referreed journal publication yet). (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The line numbers for this comment are not accurate. However, a response does not appear to be necessary.
858	83058	19	50	22	50	22	Overlap in this paragraph with the reasons for concern discussion could be reduced. (Katharine Mach, IPCC WGII TSU)	There is, of course, an overlap in the subject areas discussed in this section and the "reasons for concern". However, this section summarizes information with respect to the question of how the risks of thresholds, irreversible changes, and large scale discontinuities could be reduced. The second paragraph, for example, discusses risk- and decision-analyses in this area. This section hence provides related, but unique perspectives.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
859	61510	19	50	36	50	36	The sentence here aims to contrast the situation in Africa with that in China. Therefore, it should probably concentrate on what makes them different (I.e. the capacity of the state to regulate and facilitate development), and not refer to the lack of checks and balances (characterstics which are common to China and much of Africa). (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The line numbers for this comment are not accurate. It does not appear to refer to the SOD.
860	84408	19	50	39	50	41	As mentioned in the context of the ES, I would recommend against using "low confidence" in this formulation. It seems that you mean either that there is limited evidence and low agreement about the feasibility and requirements of such early warning systems, or that there is high confidence that the feasibility and requirements of such systems are not known currently. Either of these formulations would make the point more clearly. (Michael Mastrandrea, IPCC WGII TSU)	The sentence has been reworded according to this suggestion.
861	80589	19	51	4	0	0	I suggest re-writing this as "The likelihood of crossing tipping points due to climate change may be reduced by preserving ecosystem services" - I don't think we can be confident that these can be avoided. (Richard Betts, Met Office Hadley Centre)	Agreed, wording changed as requested.
862	64562	19	51	9	51	9	19.7.4. reference should now be to 6.3.6 (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Thank you, references changed as requested.
863	64563	19	51	9	51	9	now 30.6.2 (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Thank you, references changed as requested.
864	74209	19	51	10	51	12	Drop the reference to Cury et al. 2011. While it may be correct that “risks to seabird populations due to climate change could be lessened by reducing fishing”, We see no mention in Cury et al. 2011 of this, who instead found that fisheries that “left one-third for the birds” would provide the “minimal forage fish biomass needed to sustain seabird productivity over the long term.” (Cury et al. 2011). (UNITED STATES OF AMERICA)	Agreed – reference dropped as requested.
865	64564	19	51	23	51	23	now 6.3.6 (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Thank you, references changed as requested.
866	61511	19	51	36	51	46	Please be consistent in talking about limits "to" or "of" adaptation. The former suggests things which need to be overcome before robust adaptation can take place; the latter suggests the residual risks which are left over after adaptation. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The text has been edited to consistently refer to limits "to" adaptation.
867	81266	19	51	51	0	0	FAQ 19-1 Although an important question, the flow of the answer is confusing and disjointed. Authors may wish to revise. (Monalisa Chatterjee, IPCC WGII TSU)	We have revised and hopefully improved this statement.
868	58958	19	51	52	51	52	"size of a risk" is maybe not well understood: rather speak of "magnitude" or "level"? (EVELYNE FOERSTER, BRGM)	Sentence rewritten accordingly.
869	58959	19	52	1	52	2	It is generally admitted that the "coping capacity" is also to be included into the the final value of risk (not only exposure and vulnerability). (EVELYNE FOERSTER, BRGM)	Coping capacity is inherent in our definition of vulnerability as indicating in 19.1.
870	81267	19	52	16	0	0	FAQ 19-2 Are these another kind of indirect impacts? (Monalisa Chatterjee, IPCC WGII TSU)	Yes, in some cases the categories overlap, but an FAQ is not the place to elaborate on such details.
871	79086	19	52	23	77	24	Please check references for completeness. Several are just iven as "author, year". (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	We have now done so.
872	71409	19	52	26	0	0	Please ensure that any new figures or text added after the SOD review is thoroughly reviewed. (CANADA)	We have thoroughly reviewed the new figure as has our TSU and some WGIII authors.
873	57654	19	52	28	52	40	Gratingly naïve. (Richard S.J. Tol, Vrije Universiteit Amsterdam)	FAQs are for a general audience.
874	80544	19	52	37	52	40	This sentence appears to contradict the rest of the answer to FAQ19.3. The main answers says (and I agree) that the question of "dangerous climate change" goes beyond science alone. However the quote from the Copenhagen Accord claims that there is a "scientific view that the increase in global temperature should be below 2 degrees Celcius" and line 38 appears to endorse this by saying that "agreements reached by governments... have recognized...". This does not make sense. I suggest that the sentence "For example, agreements reached by governments.... Copenhagen Accord)." (lines 37-40) should be dropped. (Richard Betts, Met Office Hadley Centre)	This section of the FAQ has been rewritten; and we understand your concern. On the other hand, the statement from Copenhagen indicates the complexity of the matter and how difficult it can be to identify the boundary between the domain of science and the domain of policy. We think this serves an important purpose here.
875	66312	19	52	43	77	24	There are numerous references that are missing or incomplete (as I'm sure the authors are well aware!) (Timothy Carter, Finnish Environment Institute)	The reference section has been completed for the FGD.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
876	80529	19	52	43	77	24	There are a large number of references which do not include the full citation, which has made it difficult to review some parts of this chapter thoroughly. In particular, the reasons for some confidence statements cannot be traced if the cited literature cannot be found and read. May I suggest that further ongoing discussion with other chapters and checking of sources by other chapter authors will therefore be particularly important for ensuring a strong FGD. (Richard Betts, Met Office Hadley Centre)	The reference section has been completed for the FGD.
877	65541	19	60	30	60	30	The source Garschagen 2011 (online first) is now published in print and can be changed to: Garschagen, M. (2013). Resilience and Organisational Institutionalism from a Cross-Cultural Perspective – An Exploration based on Urban Climate Change Adaptation in Vietnam. In: Natural Hazards, 67(1): 25-46. (Matthias Garschagen, United Nations University)	This reference has been updated.
878	63448	19	68	43	68	43	This reference is incorrect. Is should read: "Nicholls, R. J., Marinova, N., Lowe, J. A., Brown, S., Vellinga, P., de Gusmão, D., Hinkel, J. and Tol, R. S. J., 2011: Sea-level rise and its possible impacts given a 'beyond 4°c world' in the twenty-first century. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 369 (1934), 161-181." (Diogo de Gusmao, Met Office Hadley Centre)	This reference has been updated.
879	77326	19	72	10	72	11	correct citation: Sietz, D., Lüdeke, MKB. and Walther, C. (2011) Categorisation of typical vulnerability patterns in global drylands. Global Environmental Change 21(2): 431-440. (diana sietz, Wageningen University)	This reference has been updated.
880	77327	19	72	12	72	14	correct citation: Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2012) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Regional Environmental Change 12(3): 489 - 505. (diana sietz, Wageningen University)	This reference has been updated.
881	80528	19	75	28	75	48	There are 8 papers or reports cited here on which one of the CLAs is a lead author. I can confirm that these are relevant to the topics being discussed, but to increase the independence of sources and avoid giving the impression of excessive self-citation, may I suggest that the authors check whether other literature can be cited as well or instead of some of these sources. If a significant number of these papers remain cited in the FGD, may I suggest that the authors' response to this review comment would be a good opportunity to clarify why this is necessary. (Richard Betts, Met Office Hadley Centre)	We have added additional references in the text. But we note that as often happens, the lead authors have been very active in research on important points which the chapters must deal with. It is perhaps regrettable that the literature is often not deeper.
882	78899	19	78	0	0	0	Table 19-1: many of the entries are focused only on mitigation, and hence could be argued to lie outside the scope and mandate of WGII and chapter 19. However, almost all entries (perhaps with the exception of the first one, where the link is very generic) actually have important links with regional-scale impacts and adaptation. If that link were made, the argument for retaining this table would be much stronger. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	We have retained this table because it provides a classic example of emergent risks due to the complex interactions between climate change impacts and climate mitigation. We have compressed the table to save space and did not have space to include information about adaptation.
883	79992	19	78	0	0	0	Table 19.1., 2nd line. Reducing "natural forest" is irrelevant in this respect. Please consider replacing with "deforestation". (NORWAY)	This entry has been revised.
884	79993	19	78	0	0	0	Note i. : "biofuel induced removal of primary forest" should be replaced by the term "deforestation". If primary forest is replaced by other definitions of forests it is not land-use-change according to the UNFCCC accounting rules. (NORWAY)	All notes to this table have been removed.
885	79994	19	78	0	0	0	Note ii. : This text has more to do with mitigation than adaptation, and should be addressed in WG III. The purpose of a carbon tax is to reduce GHG emissions as stated in article 2 in the climate convention. Fossil CO2 emissions and deforestation will (NORWAY)	All notes to this table have been removed. Since induced land use change is a prime example of the type of complex interaction that leads to an emergent risk, it does have a place in this chapter.
886	66313	19	78	0	78	0	Table 19-1: Useful table, though references are missing from the reference list. (Timothy Carter, Finnish Environment Institute)	The references to this table have been added to the reference list.
887	79991	19	78	0	78	0	The note (i) under Table 19-1 contains a number of interesting figures concerning the land area used for biofuel today and figures for projected increase in % by 2020 and 2030. These are compared with figures for the increase of area for food production g (NORWAY)	All notes to this table have been removed and key information has been incorporated into the main text.
888	71410	19	79	0	0	0	Suggest providing more specific detail (i.e., % decline) for agriculture linked with noted risk of a decline in agricultural production at the global scale. (CANADA)	Thank you for the suggestion, unfortunately space does not allow us to provide more specific detail.
889	83059	19	79	0	0	0	Table 19-1. It seems the 2nd to last note no longer appears in the table? (Katharine Mach, IPCC WGII TSU)	All notes to this table have been removed.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
890	83060	19	79	0	0	0	Table 19-2. Line-of-sight references and citations are needed to fully support all examples in this table, and comprehensiveness of examples should be increased. An appealing option would be to move examples from section 19.5.1 into this table. (Katharine Mach, IPCC WGII TSU)	This table has been deleted.
891	66314	19	79	0	79	0	Table 19-2: This table is obviously incomplete. However, since risks from a large temperature rise are classified as "Emerging Risks" on P26, L 27, and as these are defined as having "the potential to become key risks..." on P13, L23-24, then referring to them as "Key risks" in this table seems inconsistent. (Timothy Carter, Finnish Environment Institute)	This table has been deleted.
892	61512	19	80	0	0	0	Table 19-3: This table presents the main results of the chapter However, Table 19-3 does not provide any quantitative information. As a result, the link between this table the aggregate Figure 19.-5. supposedly informed by it is very weak. Furthermore, no comparison is possible with the AR4 where Section 19.3 and in particular Table 19.1 provided a lot of quantitative information on "key vulnerabilities" grouped by system and/or region for different levels of global warming. The authors are encouraged to either add global warmign levels to Table 19-3 or to provide a new summary table/figure showing key risks for different levels of global warming. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The former Table 19-3 now appears in its entirety as a cross chapter table CC-KR and in summary form (Table 19-4). It is based on the new systematization and differentiation of hazards, key vulnerabilities and key risks. This differentiation is based on the conceptual framework of the IPCC SREX report that also is taken into account in the AR5. A link to different levels of global warming would be possible for certain hazards, but not for various key vulnerabilities and risks. Consequently, we think that the main function of the table is to provide an overview of important hazards, key vulnerabilities and key risks identified by various chapters of the fifth assessment report. That means we are not solely refering to the importance to understand key vulnerabilities and key risks, we also assessed them and CC-KR (and the summary Table 19-4) is a core result of what is seen as key in this report in terms of core hazards, vulnerability and risk.
893	62085	19	80	0	0	0	Table 19-3. Is there a reason for not including a column on emerging risks? If so, it might be worth detailing why upfront. (Joann de Zegher, Stanford University)	"Emerging risks" is no longer a category in this chapter.
894	77776	19	80	0	0	0	A general comment on the table is that each hazard/stressor that is listed apparently results in at least one key vulnerability, one key risk and an emergent risk. Are they really all key?? Would it not be reasonable to expect that some boxes in the table should be empty because a given hazard or stressor may simply not produce a large enough vulnerability or risk to be classified as key or emergent? (Francis Zwiers, Pacific Climate Impacts Consortium)	The table has been modified. Overall, we think that table now covers core phenomena and aspects that different chapters found to be most relevant to characterize key vulnerabilities and key risks in their area/thematic focus.We also disagree with the idea that a hazard produces vulnerability. In most cases societies and ecosystems are vulnerable to a hazard or climatic change, but the factors that influence the vulnerability are not necessarily linked to environmental change. This understanding is also confirmed by the new definition of vulnerability (see glossary).
895	77777	19	80	0	0	0	A second general comment is that some parts of the table do a good job of pointing back to the traceable account that supports the identification of the risk, but this is not uniformly the case. It would be desirable if detailed pointers (to the subsubsubsection level ...x.x.x.x) could be provided in all cases. (Francis Zwiers, Pacific Climate Impacts Consortium)	The table has been modified and we received additional input from various chapters. This input also improves the traceable accounts, hence in many cases specific cross-references to the chapters are provided. Within the chapters the specific sources of literature are shown.
896	77778	19	80	0	0	0	A final general comment is that it is not clear how chapter 19 should fit into this table. It comes into the table on page 84 under the heading "Emergent risks and key vulnerabilities", but it seems a bit odd to provide this title since the columns also have these titles. (Francis Zwiers, Pacific Climate Impacts Consortium)	This is correct, we have the challenge that various key vulnerabilities and key risks we deal with and refer to in our chapter text are also mentioned as key vulnerabilities and key risks in other chapters with slightly different foci. Overall, we therefore limited our contribution to the cross chapter table to those issues that other chapters do not really touch.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
897	80425	19	80	0	0	0	Table 19-3: Table now includes WGI references regarding changes of temperature, precipitation, and SLR. However, extreme events have not yet been cross-referenced to SREX or WGI AR5. Please link to WGI AR5 wherever possible. Please ensure consistency of reported physical impacts/hazards combined here from several WGII chapters with the SREX and WGI AR5 assessment of the physical science basis. (Gian-Kasper Plattner, IPCC WGI TSU)	Good point, however, the main emphasis of this table is the presentation of key vulnerabilities and key risks that are linked to hazards, but the emphasis is on vulnerability and risk.
898	80565	19	80	0	0	0	The last sentence of the caption to Table 19-3 ("The table illustrates that current global megatrends...that go far beyond existing adaptation and risk management capacities, particularly in highly vulnerable regions") seems a bit of a sweeping assertion to me, and an odd statement to make in the caption. (Richard Betts, Met Office Hadley Centre)	The text has been modified. However, the point that the table also shows that various megatrends, such as urbanization or demographic change influence vulnerability and hence risk is an important statement. It means that in some cases it will be very difficult to actually change risk and vulnerability patterns through adaptation strategies. E.g. it is nearly impossible to fundamentally change the increasing exposure of people to potential coastal hazards in Asia, since the increasing exposure is heavily determined by rapid urbanization processes in coastal zones.
899	80754	19	80	0	0	0	It seems to me that links to chapter 5 (5.4.2.4), in which impacts of calcifiers and coral reefs are discussed, is needed. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	The table has been modified and various chapters provided new input.
900	83061	19	80	0	0	0	Table 19-3. Line-of-sight references should be provided for examples from all chapters. For chapters presenting much longer examples than others, condensation and refinement could be considered. In terms of framing of this table, the presentation of specific risks implies inevitability, not agency. How do these risks increase with level of climate change or in the near term versus the long-term? What is the potential for risk reduction through adaptation? Are there any potential synergies that could be achieved in thinking about the framing of SPM table SPM.4 in the context of this table? (Katharine Mach, IPCC WGII TSU)	The timing issue is one of the criteria for assessing whether a risk is key or not. Consequently, it is indirectly considered. However, compared to the other risk-adaptation table, the timing has not such an important position in this table. The table aims to provide important information on key determinants of risk and consequently, it shows that the AR5 authors did a real assessment of the specific patterns that lead to key risks (considering climate related hazards and non-climate related factors that drive vulnerability and exposure). The key risks as well as the key vulnerabilities and hazards show the configurations that need to be changed when aiming to develop adaptive capacities and resilience.
901	84409	19	80	0	0	0	Table 19-3: In line with my general comments on the chapter, this table is a prime location where it would be useful, to the extent supported by the literature, to differentiate the timing of when risks might materialize (near term vs. long term), the potential or lack of potential for mitigation and adaptation to reduce them (through reducing the hazard/stressor, reducing the relevant key vulnerabilities, or both), etc. The conclusions coming out of 19.7 get at some of this in more general terms, but these details are relevant to the criteria presented for identifying key risks and thus the specific entries in this table. In addition, it would be useful to consider how this table intersects with the future risk table presented in the SPM/TS (SPM.4), which attempts to differentiate on some of these bases. Please also provide line of sight to specific chapter sections for each entry. Finally, there may be opportunities for condensation in cases where specific chapters have provided many entries. (Michael Mastrandrea, IPCC WGII TSU)	We have discussed timing to the extent that the literature allows and we felt that a table is not a good place to discuss such a complex issue. Additionally, yes in general we agree, however, the various chapters show where the information on hazards, key vulnerabilities and key risks is coming from within their chapter. In these specific chapters the literature sources are documented. Hence, it would be a bit too much information, if the cross chapter table has to include also all the references that were the basis for the judgements of the different chapters. However, representative lines of sight are provided.
902	58101	19	80	0	86	0	Table 19.3. In the regions summary there is no summary for SA and CA or the Caribbean, LatCab region. (Carmen Lacambra Segura, Grupo La era)	For the FGD, we have now received input from all regional chapters, including the Central and South America and Small Islands chapters.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
903	66315	19	80	0	86	0	Table 19-3: I don't doubt that the examples of Emergent risks are drawn from other chapters, but are these all backed up by sufficient evidence (observational, experimental or modelled), or are some of them merely plausible risks that are conditional on the occurrence of hypothetical compound events or combinations of circumstances? For example, on P80, final row on algal blooms: "Disproportionate enhancement of risk due to interactions of various stresses" is pretty vague, though it does have a cross-reference. Air pollution (P82, row 2) "Complexity and compounding of health crises" has no specific cross-reference (in common with other entries on the row) apart from Chapter 8. There are many more similar entries that seem to be judgements by the authors (either of this chapter or the source chapters), which is fine but then this needs to be stated explicitly and to be reconciled with the earlier definitions of different types of risks. This is particularly important as elements of the Table are currently in the SPM. (Timothy Carter, Finnish Environment Institute)	There is now a detailed description of how judgments were made in section 19.6.2.1.
904	80943	19	80	0	86	0	Table 19-3 The chapter team may wish to consider adding columns to identify the critieria under which these risks, vulnerabilities are key, and emergent. If this information is solicited from different chapter team, then it may be a useful exercise to ensure that each chapter team is using similar/comparable framing for identifying their key risks, vulnerabilities. (Monalisa Chatterjee, IPCC WGII TSU)	In some areas chapters provided this information (on how the criteria for assessing whether a risk or vulnerability is key were used), however, the weighting of the different criteria differs from chapter to chapter and in some cases from topic to topic. Consequently, this information is relevant if you want to examine a specific key vulneraiblity or key risk, however, for a cross-chapter table that aims to provide an overview this information is not a necessity. In addition, not all chapters have shown us how they applied the different criteria and which criteria were the most important once for the specific vulnerabilities and risks identified.
905	77779	19	81	0	0	0	Under food security, wouldn't changes in mean precipitation and precipitation extremes be a concern? (Francis Zwiers, Pacific Climate Impacts Consortium)	The input was discussed in different iterations with the chapter again.
906	77780	19	81	0	0	0	First row under urban areas, third column, suggest replacing "Increasing urban flooding" with "More frequent urban flooding". (Francis Zwiers, Pacific Climate Impacts Consortium)	The input was discussed in different iterations with the chapter again.
907	77781	19	81	0	0	0	First row under urban areas, fourth column, suggest making it clear that the interaction with changes in wealth and urban density make this risk emergent. (Francis Zwiers, Pacific Climate Impacts Consortium)	The input was modified and the urban chapter provided a lot of information on hazards, key vulnerabilities and key risks.
908	77782	19	81	0	0	0	Second row under urban areas, fourth column, wouldn't storm surge also be a concern? (Francis Zwiers, Pacific Climate Impacts Consortium)	The input was discussed in different iterations with the chapter again.
909	74210	19	86	0	0	0	The section of the table on North America states "increases in frequency and/or intensity of extreme events...." The "and/or" makes it very vague. Should it be: ... increases in the intensity of extreme events (e.g., hurricanes) and the frequency of intense events." Does the science back up the statement of "increases in the frequency of extreme events regarding hurricanes?" Thus, the "and/or" is misleading. (UNITED STATES OF AMERICA)	The information and input from the North America chapter has been modified and replaced.
910	77783	19	86	0	0	0	First row under North America, be careful with the allusion to hurricanes given the more nuanced assessments on changes (historical and future) of tropical cyclone frequency in the SREX report and in WG1 AR5. (Francis Zwiers, Pacific Climate Impacts Consortium)	The information and input from the North America chapter has been modified and replaced.
911	77784	19	86	0	0	0	Second row under North America, first column - be clear that the story on project runoff changes is seasonally and regionally variable within the continent. (Francis Zwiers, Pacific Climate Impacts Consortium)	The information and input from the North America chapter has been modified and replaced.
912	78900	19	86	0	0	0	Table 19-3: Australasia: three points. First: we do not link the potential for sea level rise to exceed 1m only to beyond 2100. Based on WGI, we certainly cannot rule out sea level to exceed 1m even before 2100, the likelihood only increases even further beyond 2100. Suggest you delete "beyond 2100". Second: we actually classify the issue of compound events and cumulative adaptation needs as an "emerging" rather than "emergent" risk. It certainly is the latter, but the literature on this is still quite thin, and hence we felt in Chapter 25 that this should be classified as an emerging risk only. Third: Chapter 25 identifies eight regional key risks. We realise you are space limited and can live with Chapter 19 having to make a selection, but if there is a way to include all eight, this would give a more balanced reflection of chapter 25. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	The input of the Australasia chapter has been modified by its CLA Andy Reisinger, the author of this review comment. We thus assume that he is satisfied with the revised version and has taken this point into consideration in its revision.
913	58960	19	87	0	0	0	Image resolution of Figure 19-1 is very bad: maybe should be improved? (EVELYNE FOERSTER, BRGM)	This figure has been improved and brought up to specification by the TSU for the FGD.

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914	74211	19	87	0	0	0	Figure 19-1: In the left-hand portion of the figure, "natural variability" could be rephrased to "natural variability and change", to reflect the presence of long-term and step changes in the natural climate system that do exist independent of anthropogenic forcing. (UNITED STATES OF AMERICA)	You are correct but we need to keep an already-complex figure as simple as possible. The term "variability" encompasses variations at many timescales, including "change (multidecadal variations)".
915	83062	19	87	0	0	0	Figure 19-1. In grouping the vulnerability and exposure, it seems one could argue that important subtleties are lost. Especially in developed versus developing countries, there can be differing trends in vulnerability versus exposure that the "propeller" version of this figure better captures. For both impacts and adaptation, vulnerability versus exposure can have differing implications, which are less distinguished here. (Katharine Mach, IPCC WGII TSU)	The figure has been redrawn to separate vulnerability and exposure.
916	84410	19	87	0	0	0	Figure 19-1: I like new version of this figure, but feel that one change should be reconsidered--merging vulnerability and exposure into one sphere. I understand the design reasons for doing so, but feel that the distinction between exposure and vulnerability and their consideration as interacting but separate components of risk is a key conceptual point that is lost if they are presented together. I would recommend separating them again, determining a way to represent key and emergent risks in that layout. A small additional point to consider: replacing "natural variability" with "climate variability" in the left-hand side of the figure. This is the term used already in the caption. (Michael Mastrandrea, IPCC WGII TSU)	See response to 915.
917	63731	19	87	0	87	0	Figure 19-1 does not fit to Table 19-3, where for oceans also key vulnerabilities are named (which do not relate to socio-economic developments). Please change Figure 19-1 to include next to socio-economic developments also bio-physical and socio-economic characteristics as important influence factors for vulnerability as included in the definition of vulnerability. (GERMANY)	We have modified the caption to mention that hazard can modify exposure and vulnerability.
918	63732	19	87	0	87	0	Figure 19-1: Please change: 1. Climate change signals and physical impacts instead of physical hazards (physical hazard is not defined in the glossary, hazard relates to events not to trends in the glossary), 2. Socio-ecological impact on humans and ecosystems instead of risk in the center of the figure, 3. Risk instead of impacts on humans and ecosystems as assessment step outside of the circles. Please make clear that risk is an assessment step to assess impacts (or consequences) in regard to their damage capacity and their probability. Risk still can be a central term but it should be taken out of the circles and put on an arrow. (GERMANY)	We think the proposed change is unnecessarily complex. We have changed our definitions to make these relationships clearer.
919	66316	19	87	0	87	0	Figure 19-1: Nice figure. (Timothy Carter, Finnish Environment Institute)	Thank you.
920	80944	19	87	0	87	0	Figure 19-1 The chapter team may re consider integrating the vulnerability and exposure components. In SREX, these concepts have been seperated and the distinction between the two has been a useful bit of detail in the conceptual framing of the report. (Monalisa Chatterjee, IPCC WGII TSU)	see response to 915.
921	68121	19	88	0	0	0	Figure 19-2 gives no examples on significant disaster impacts felt in other Asian regions like East Asia and Central Asia. It is suggested to add examples of Asia according to relevant chapters such as Chapter 24. (CHINA)	Thank you for the useful comment. However, Figure 19-2 collects examples of area of compound risk, not disasters that have been recently observed.
922	68122	19	88	0	0	0	Fig19-2 contains a world map with national borders. It is suggested to use a map without borders to avoid unnecessary disputes. (CHINA)	This figure has been revised by the TSU and no longer contains nation state boundaries.
923	74212	19	88	0	0	0	Figure 19-2: Recommend deleting the word "salient." (UNITED STATES OF AMERICA)	Deleted.
924	78901	19	88	0	0	0	Figure 19-2: if ther figure is kept, please ensure that the lines connecting the Australia/NZ boxes point more closely to the places where the impacts would actually occur (i.e. where the relevant montane ecosystems are, and to somewhere between Australia and New Zealand for settlement risk, rather than to the north-west of Australia). (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)	This figure has been revised and improved upon by the TSU.
925	80543	19	88	0	0	0	Figure 19-2 needs references to discussion in the main text and/or literature citations. Also there is a risk that this could be seen as "cherry-picking" as there are so many studies available now that it is probably possible to find studies suggesting negative impacts almost anywhere - but these may be inconsistent with each other as they may use different climate scenarios (eg: different climate models with different regional climate responses). I think this figure would be more robust if it could dig deeper into the multiple impacts and identify where they are internally consistent (eg: all using the same climate model, or backed up by several climate models). The Inter-Sectoral Impacts Model Intercomparison Project (ISI-MIP) may be very useful here. (Richard Betts, Met Office Hadley Centre)	We have added references to supporting sections to each of the entries on the map. Additionally, we are clear in the text that what we are providing is an illustrative sample. Piontek (2013) is additionaly refered regarding the ISI-MIP analyses.
926	81432	19	88	0	0	0	Figure 19-2: Could use some color to give contrast. (Yuka Estrada, IPCC WGII TSU)	This figure has been revised by the TSU.

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927	83063	19	88	0	0	0	Figure 19-2. Would it be possible to provide, within each box, specific line-of-sight references to relevant chapter sections? In the upper leftmost box, it would be preferable to specify the types of extreme weather events meant. In the box for Dhaka, presumably the text should start with "risks..."? Overall, is there any possibility of indicating the degree to which these risks are relevant in the near term versus the long-term, across levels of climate change, etc.? (Katharine Mach, IPCC WGII TSU)	We have added references to supporting sections to each of the entries on the map. All the entries have been aligned to begin from "Risk to/from". Regarding the relevances of risks in the near term (era of responsibility) versus the long-term (era of climate options) or across levels of climate change, they cannot be specifically mentioned here due to the limited descriptions in the referenced chapters.
928	84411	19	88	0	0	0	Figure 19-2: I would suggest adding cross-references to Chapter 19 sections and/or sections of other chapters in each box for line of sight purposes. This figure also packs a lot of information in compact form, and I would recommend enlisting the help of a graphics expert in enhancing the visual accessibility of the figure. (Michael Mastrandrea, IPCC WGII TSU)	We have added references to supporting sections to each of the entries on the map.
929	80945	19	88	0	88	0	Figure 19-2 The figure will be more appealing and user friendly if some visual symbols are used instead of text here. The TSU can provide help with graphics. (Monalisa Chatterjee, IPCC WGII TSU)	This figure has been revised by the TSU.
930	57622	19	89	0	0	0	Fig.19-3, Please check if these five catalogues in the figures on "Confidence in Quantifying Responses" are consistent with other IPCC AR5 reports? (GE GAO, National Climate Center,China)	The figure has been amended to include references to appropriate sections in other chapters and boxes of the AR5
931	79995	19	89	0	0	0	Fiure 19-3: Please consider including a feedback loop between society and increases in atmospheric CO2. (NORWAY)	Agreed. The connection has been indicated in the figure.
932	81433	19	89	0	0	0	Figure 19-3: This figure is depicting risks from ocean acidification without using the word “risk” even a single time! It is not clear if this figure adds too much value to this chapter unless the main focus of this figure is simply to illustrate the pathways by which OA affects the systems, but that is discussed elsewhere. (Yuka Estrada, IPCC WGII TSU)	This figure is not intended to portray risks, but rather how the confidence in quantifying responses decreases along the pathway from the root forcing (increased atmospheric CO2) to how ocean acidification ultimately affects society.
933	83064	19	89	0	0	0	Figure 19-3. This figure should be coordinated with the figure in the cross-chapter box on ocean acidification. (Katharine Mach, IPCC WGII TSU)	The figure now makes explicit reference to the OA box. We decided it provided value added and therefore retained it.
934	84412	19	89	0	0	0	Figure 19-3: This figure covers similar ground to panel A of the figure in the ocean acidification cross-chapter box. I recommend considering the overlaps between these figures and coordinating the presentation of this material. In terms of the presentation of this figure, the current color gradient is a bit subtle in differentiating "very low," "low," and "medium," and these differences may not show up clearly on every computer screen/printout. I would suggest making these categories a bit more distinct for clarity. (Michael Mastrandrea, IPCC WGII TSU)	The figure has been amended with stronger color gradient. While the figure is similar to the CC-OA figure, it has a different emphasis and coordinating the two figures was not deemed useful.
935	58102	19	89	0	89	0	Figure 19.3. A clarification that the confidence on quantifying the effects of acidification decreases with the chain, perhaps would be helpful, so the reader does not think that is because there are less effects but that at the moment current knowledge and research has not focused on such quantification (Carmen Lacambra Segura, Grupo La era)	This is a good point. The caption is amended to reflect that the lower confidence does not imply fewer impacts.
936	66317	19	89	0	89	0	Figure 19-3: This is a good figure, but unless my eyesight is deceiving me (a conceivable scenario) two of the confidence shading tones seem not to be used (low and high) so why bother with them? Additionally, increases in atmospheric CO2 appear to be assigned no measure of confidence at all (white box), when this should probably have the highest confidence of all! (Timothy Carter, Finnish Environment Institute)	The colors used in the figures have been amended to increase the contrast. The increases in atmospheric CO2 box has been assigned a Very High confidence rating.
937	80946	19	89	0	89	0	Figure 19-3 It is not clear why this figure is useful for the chapter. Ocean acidification cross chapter box figure provides a much detailed explanantion of this information, perhaps the chapter team could refer to that figure. (Monalisa Chatterjee, IPCC WGII TSU)	While the figure is similar to the CC-OA figure, it has a different emphasis and refering to the CC-OA figure was not deemed useful.
938	64565	19	90	0	0	0	Figure 19-4: ch 6 .2.3.4 p 20 indicates the possibility of increased AND decreased nitrogen fixation under elevated CO2. It may be better to present the changes of N2 fixation in a way more balanced with chapter 6 here? ch6 p 21 L 6-7: low confidence that there is an increase in nitrogen fixation wich progressive OA. ch 19p 28 L 33-34 low to medium confidence that nitrogen fixation rates will be stimulated ch 19p 28 L 33-34 The figure should display the same contents as the text (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	This figure has been deleted.

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939	80464	19	90	0	0	0	Figure 19-4 makes a good effort at conveying a difficult concept but comes up short. By reducing the 4-dimensional criteria for identifying a key risk (magnitude, uncertainty, irreversibility, vulnerability) to a 2-dimensional graph, the authors may mislead readers. Also, the dotted line seems to indicate a clear line where risks become key, but instead it may be better represented by an isoquant along which the importance of the risk is roughly equal. (Robert Heilmayr, Stanford University)	This figure has been deleted.
940	81434	19	90	0	0	0	Figure 19-4: The diagram is relatively simple and offers little information, but the caption is dense and hard to follow. The figure as it is does not offer too much added value as a visual aid. Some information in the caption, (i.e., heights and width of the boxes) can be incorporated graphically. (Yuka Estrada, IPCC WGII TSU)	This figure has been deleted.
941	83065	19	90	0	0	0	Figure 19-4. Is it possible to add more "data" to this figure? Currently, the content seems slim as compared to the more elaborate structure of the graphic. (Katharine Mach, IPCC WGII TSU)	This figure has been deleted.
942	84413	19	90	0	0	0	Figure 19-4: I am not convinced that this figure communicates effectively in its current form. The placement of the contour of equal risk is arbitrary to some extent, and could be placed a different levels by different people based on differences in judgments about how the criteria for determining "key" map onto this space. Thus, it is not completely clear why the intersection of this contour with the boxes for N-fixation and coral calcification is indicative of key risks, even in broad terms. In theory, one could place the contour such that it also intersects the calcification box. If the figure is retained, I would omit presenting the intersection as a reason for stating that reduction in calcification is considered a key risk but that N-fixation may or may not be a key risk. In the caption, I would also make it clear that the current line is not the only possible placement. (Michael Mastrandrea, IPCC WGII TSU)	This figure has been deleted.
943	66318	19	90	0	90	0	Figure 19-4: I'm not fully convinced by this figure. The positioning of the equal probability line is arbitrary, and the statement in the caption about heights being greater than widths, is meaningless, given that the two axes show different units, both on relative scales, with the heights and widths simply a function of how the scales are plotted. This depicts some hypothetical future situation with a pretty wide range of CO2 concentrations (560 to 840 ppm) and the meaning assigned to magnitudes of impact also undefined. Furthermore, the likelihoods on the horizontal axes are of changes in the process, where the processes on the figure already show changes (increases or reductions). So are these likelihoods of changes in the changes, or changes in the rate of changes, or what? (Timothy Carter, Finnish Environment Institute)	This figure has been deleted.
944	80947	19	90	0	90	0	Figure 19-4 It is very difficult to understand this figure and the topic is narrow in reference to the actual scope of the chapter. (Monalisa Chatterjee, IPCC WGII TSU)	This figure has been deleted.
945	57560	19	91	0	0	0	Figure 19-5. 1) Please clarify "past" means since pre-industrialization or not. 2) Clarify when is present. Is it 2010 or 2014 or some other year? From the Figure, present seems to be different from the time when temperature increase was 0. 3) In the last line of the explanation of this Figure, there is a description that "if a global temperature rise of 2 degree were exceeded". Please clarify when, is it from 1990? 4) There are explanations about the left hand bar in Figure 19-5 in lines 48-50 on page 40, descriving a transition to red is located at 1 degree and also a transition to purple is located around 2 degree. This explanation is not consistent with the Figure. Also please add this explanation to Figure 19-5 and in doing so, make it clear the base year from when 1 degree and 2 degree are counted (in reading lines 48-50 of page 40, this seems to be from 1990). 5) Does the temperature increase in this Figure mean in 2100 or at the equilibrium? 6) Please make it clear that adaptation is not included in the same way as in Figure SPM 2 of AR4/WG2. 7) Please add the note to this Figure that the risk varies depending on development pathways and this is not reflected in this Figure. (This point is well explained in Figure 19-6. It is better, however, to add also in Figure 19-5 to avoid any misunderstandings). (Mitsutsune Yamaguchi, The University of Tokyo)	We have revised this figure and its caption to explicitly label pre-industrial and recent temperatures, including the specific definition of each. We have made sure references to specific temperature changes make explicit the assumed baseline, and that the text and figure are consistent in where color transitions occur. We have emphasized in the text that the burning embers diagram (19-5) assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk.
946	57563	19	91	0	0	0	Figure 19-5. In the explanatory note for the figure, there is a description that "The levels of fisk illustrated reflect the judgements of Chapter 19 authors". Though I pay full respect of the expertise the authors have on this issue, this may sound as subjective. At least there should be several literatures supporting the authors' judgement. And if there are contrary views in literatures, those views should also be highlighted here. (Mitsutsune Yamaguchi, The University of Tokyo)	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2.

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947	62722	19	91	0	0	0	Figure 19-5; The figure is very different from the corresponding figure of TAR. However, most estimates follow those of AR4. The figure is almost the same as the figure in Smith et al. (2009) which developed based on the AR4. Therefore, please clearly describe that the revision of the figure is not based on the insights of AR5 but is mainly based on the insights of AR4. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	The 2nd paragraph of section 19.6.3 explicitly compares the judgments represented in figure 19-5 with those of Smith et al (and AR4). While use was made of the Smith et al and AR4 judgments as a point of reference, section 19.6.3 represents a new assessment of the RFCs on which to base a new version of the burning embers diagram. Where embers do not change appearance much, new literature has not supported such a change, or has only supported a change in the confidence attached to judgments, which is also important.
948	62723	19	91	0	0	0	Figure 19-5; The figure was developed by the expert judgment of LAs of Chapter 19. However, the figure is almost the same as the figure in Smith et al. (2009), although the experts are different between the two. It is very unnatural. Rather, I will recommend to revise to the explanation that the figure was developed based on Smith et al. (2009) with revision only for purple color which are judged by the LAs of Chapter 19. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	The 2nd paragraph of section 19.6.3 explicitly compares the judgments represented in figure 19-5 with those of Smith et al (and AR4). While use was made of the Smith et al and AR4 judgments as a point of reference, section 19.6.3 represents a new assessment of the RFCs on which to base a new version of the burning embers diagram. Where embers do not change appearance much, new literature has not supported such a change, or has only supported a change in the confidence attached to judgments, which is also important.
949	63077	19	91	0	0	0	Figure 19-5 (see also Box SPM.6 Figure 1, and my comment there): The graphic design of this key figure is not overly appealing (including type of letter, graphic features etc). Is the reason for this that the corresponding figure from TAR should be replicated (as an update), such that everyone recognizes the figure (style)? If this is not the case, I suggest improving the graphic design, it is really not up to today's standards. Other than the graphic aspects, there remain a number of questions on this figure (see also my comments on section 19.6.3). I think a statement in the caption should be included concerning the reference period. Is it the same as for TAR / Smith et al 2009, in terms of 0°C? (Christian Huggel, University of Zurich)	The graphic design of the figure has been improved. The reference periods for preindustrial and recent temperatures have now been explicitly defined in the figure.
950	67901	19	91	0	0	0	Figure 19-5. 1) Please clarify "past" means since pre-industrialization or not. 2) Clarify when is present. Is it 2010 or 2014 or some other year? From the Figure, present seems to be different from the time when temperature increase was 0.3) In the last line of the explanation of this Figure, there is a description that "if a global temperature rise of 2 degree were exceeded". Please clarify when, is it from 1990?4) There are explanations about the left hand bar in Figure 19-5 in lines 48-50 on page 40, describing a transition to red is located at 1 degree and also a transition to purple is located around 2 degree. This explanation is not consistent with the Figure. Also please add this explanation to Figure 19-5 and in doing so, make it clear the base year from when 1 degree and 2 degree are counted (in reading lines 48-50 of page 40, this seems to be from 1990). 5) Does the temperature increase in this Figure mean in 2100 or at the equilibrium?6) Please make it clear that adaptation is not included in the same way as in Figure SPM 2 of AR4/WG2.7) Please add the note to this Figure that the risk varies depending on development pathways and this is not reflected in this Figure. (This point is well explained in Figure 19-6. It is better, however, to add also in Figure 19-5 to avoid any misunderstandings). (JAPAN)	We have revised this figure and its caption to explicitly label pre-industrial and recent temperatures, including the specific definition of each. We have made sure references to specific temperature changes make explicit the assumed baseline, and that the text and figure are consistent in where color transitions occur. We have emphasized in the text that the burning embers diagram (19-5) assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk.
951	74213	19	91	0	0	0	Figure 19-5: How can the Risk associated with Extreme Weather Events be yellow for the present and associated with moderate risk when the confidence in attribution for extreme precipitation, floods, droughts and tropical cyclones is obseved to be medium confidence at best, as per Chapter 18. This figure needs to be consistent about the present and past with Chapter 18 and not a recreation of the figure contained in one academic paper. (UNITED STATES OF AMERICA)	The text has been revised to explicitly draw on the judgments in Ch 18 in order to define the level of risk at recent temperature. As indicated in the 2nd and 3rd paragraphs of 19.6.3, we define the transition from neutral to moderate risk (white to yellow color) based in part on having at least medium confidence in detection and attribution of impacts, as judged in Ch 18.

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952	74214	19	91	0	0	0	Figure 19-5: The burning embers diagram could be strongly improved. There needs to be more discussion of how the authors quantify the risk for the different areas. To say that this is subjective judgment of the authors is not enough. There needs to be an explicit discussion of the relative risks within this figure. Another issue is the need for clarity on what factors are being assessed. Definitions for the five reasons for concern are not consistent between Chapters 18 and 19 and this figure is picked up in the TS and SPM. One way to fix this could be to include a complimentary RFC figure reflecting chapter 18 conclusions for observed attribution and have these both included in the SPM. (UNITED STATES OF AMERICA)	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2. We have made judgments consistent with those in Ch 18 by explicitly drawing on them to define the level of risk at recent temperature. While definitions of the five RFCs are the same between chapters, our judgments about risk at higher temperature levels are frequently based on a subset of factors included in a particular RFC.
953	74215	19	91	0	0	0	Figure 19-5: The figure implies linearity of responses throughout, despite report repeatedly stating that nonlinearities pervade the system. Please address in the figure or caption. (UNITED STATES OF AMERICA)	We explicitly address nonlinearities in responses to temperature increase in RFC3 (related to agriculture) and RFC5 (related to ice sheet distintegration). In other RFCs, there is insufficient evidence to explicitly represent them in the burning embers diagram.
954	74216	19	91	0	0	0	Figure 19-5: The phrase from Pg 39 line 10:"This figure does not address issues related to the rates of climate change or when impacts might be realized." needs to be copied into the figure caption . It is very important to understanding the figure. (UNITED STATES OF AMERICA)	The caption to Figure 19-5 (now 19-4) has been modified to indicate that rates and timing of change are considered in assessing RFCs 1 and 5.
955	80542	19	91	0	0	0	The caption for Figure 19-5 and the inclusion of the new colour needs to be discussed with other chapter Lead Authors. The assessment that "climate change impacts would outpace adaptation for many species and systems if a global temperature rise of 2C were exceeded" may be an over-simplification - the use of "outpacing" relies on consideration of rate of change, whereas only magnitude (2C) is quoted here. There needs to be a time factor included. Also the statement of "high confidence" needs very careful consideration and discussion, and reference to relevant sections in the text with discussion of extensive evdence - high confidence implies strong evidence and agreement and this needs to be clear here. (Richard Betts, Met Office Hadley Centre)	The statement referred to has been removed from the caption and the text, and the confidence statements have been more explicitly tied to judgments made already in AR4 as well as to judgments made in other WG2 chapters. The transition to purple (new color) is based on the very high risk of extinction at that level as well as limited ability to adapt to impacts on coral reefs and Arctic sea ice-dependent systems.
956	81435	19	91	0	0	0	Figure 19-5: The x-axis categories should be explained in more detail. Perhaps, it would help the audience if the caption includes a simple example for each category, possibly with an accompanying table directly under the x-axis. Since this figure is one of the most used figures in the IPCC assessments, I would also appreciate a caption that is comprehensible to a wider range of people including the general public who have never seen “burning embers” before. A brief explanation of why the interpretation is slightly different from bar to bar may be also helpful. For instance, the yellow to orange portions of the far two left columns seem to be identical but the furthest left is labeled as “risk to some” and the second left is labeled as “moderate risk.” (Yuka Estrada, IPCC WGII TSU)	Explaining each RFC in detail is not feasible within the figure. We have made sure the main text contains sufficient description of each RFC.
957	83066	19	91	0	0	0	Figure 19-5. Is it possible to advance this framework further, beyond the assessment that has come before? One option would be to take the approach of figure SPM.5 displaying each RfC within a "wedge" with risk depicted in the near and long term. The potential for adaptation to reduce risk and the ways risks vary with increasing level of climate change could be depicted. As a reference for the chapter team, the TSU is preparing a potential mock-up of this concept for the chapter team to consider. Another option could be bringing adaptation/vulnerability into this figure as done in chapter 25 in the context of regional key risks: in one or 2 graphics, bars could also be presented for risks with "full" proactive adaptation. As a more minor point, if the current visualization is retained, could a fine dotted line be used to specify the current level of temperature increase on the graphic? (Katharine Mach, IPCC WGII TSU)	After considering many options we have retained the current figure, along with figure 19-6 (now 19-5) to illustrate sensitivity to development pathway. We have added a line to indicate a recent temperature baseline.
958	84414	19	91	0	0	0	Figure 19-5: The reference period for the temperature scale used in the figure should be specified in the caption, to avoid confusion, even though it also appears in the definition of the y axis. Taking a step further, the author team could consider cross-referencing Working Group I regarding where "current" temperatures fall on this scale. (Michael Mastrandrea, IPCC WGII TSU)	We have not indicated the temperature scale in the caption, but have made it more explicit and more prominent in the figure itself. We have also chosen definitions consistent with WG1.
959	63733	19	91	0	91	0	Figure 19-5: This figure is highly policy relevant. Vertical axis shows the increase in Global Mean Temperature above 1990. Please make reference to the íncrease in Global Mean Temperature since the beginning of industrialization. (GERMANY)	The reference periods for preindustrial and recent temperatures have now been explicitly defined in the figure.

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960	66319	19	91	0	91	0	Figure 19-5: Ah, the burning embers revisited! Well, the RFC definitions are slightly revised to be consistent with the altered definitions in this chapter compared to TAR and Smith et al (2009). In addition, the text provides good supporting justification for the entries shown on the revised columns. This figure also appears in the draft SPM, but Figure 19-6 offers an excellent critique and persuasive arguments for NOT including this in the SPM. The arguments for omission from the SPM would include: a too generalised concept, lacking at least two key dimensions (rates, vulnerabilities) as well as being overly subjective (both in execution and reader's interpretation). Perhaps policy makers like this imprecision and I don't mind seeing this in the chapter here for continuity, as long as the basic assumptions about development pathways (defining vulnerability and rates of change) are made explicit (as described in constructing Figure 19-6). Do the embers as depicted here follow a scenario such as SRES A1B or B2? Without the rate of change, the purple adaptation addition becomes somewhat moot. Furthermore, why is purple not applied to the other RFCs? (Timothy Carter, Finnish Environment Institute)	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2. We have emphasized in the text that the burning embers diagram (19-5, now 19-4) assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk, and that figure 19-6 (now 19-5) illustrates the senstivity to development pathways. The purple color (very high risk) has now been more clearly defined and applied to an additional RFC since the SOD (distributional impacts) based on evidence of limited ability to restore crop yields reduced by climate change.
961	71411	19	91	0	91	0	Spelling of "positive" within the figure itself needs to be corrected in the "Increased risk in all metrics" Updated Reason for Concern (RFC) (CANADA)	Fixed.
962	62724	19	92	0	0	0	Figure 19-5; Purple coloer can be seen from around 1.5 degrees C in the figure; however, the text describes that the purple is from 2 degrees C. The figure should be revised to meet the text. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	Color transitions have been refined so that appearances match descriptions in the text.
963	62725	19	92	0	0	0	Figure 19-6; The concept of this figure is important and should be kept in the AR5 report. On the other hand, I am concern about the consistency that the evidences for developing figure 19-5 do not i n c l u d e estimates based on such as an estimate based on the SRES-A2 scenario which is a vulnerable scenario. Please check the descriptions section and Smith et al. (2009). (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	We have edited the text to be much more explicit about risk judgments reflected in the burning embers diagram. In the 2nd and 3rd paragraphs of the revised version of the section, we give definitions for colors and transitions between them that are guided by the criteria for defining key risks and vulnerabilities presented in 19.2.2. We have emphasized in the text that the burning embers diagram (19-5, now 19-4) assumes middle-of-the-road socioeconomic development pathways interacting with different levels of climate change to produce risk.
964	74217	19	92	0	0	0	Figure 19-6: This figure is hard to follow. Some additional explanatory information and context regarding "burning ember" diagrams is required or consider deletion. It is confusing to reference the SRES when this cycle is underpinned by RCPs. (UNITED STATES OF AMERICA)	We have clarified the text explaining this figure and its relation to figure 19-5 (now 19-4). We have retained the reference to SRES since more impact literature is available that is based on SRES rather than on RCPs.
965	80541	19	92	0	0	0	Figure 19-6 is an extremely useful step beyond the traditional Burning Embers diagram and I fully support inclusion of this figure. The dots showing the increase in global mean temperature for B1 and A2 ought to be at the "Best estimate" of global warming for each scenario, with error bars showing the "likely range" - there is an inconsistency here, as the dot for B1, 2100 is at 3C warming which is at the upper end of the AR4 "likely range" of 1.1-2.9C (relative to 1980-1999), whereas the dot for A2, 2100 is at 4C which is much nearer the best estimate (3.4C) than the upper end of the "likely range" (2.0-5.4). (See AR4 WG1 SPM table SPM-3 and Figure SPM-5). Also, this figure seems to hinge critically on the assumption that previous Burning Embers authors have made judgements consistent with medium vulnerability. Why not actually check with those authors and include them as Contributing Authors here? Also I didn't really see this figure reflected in the Exec Summary, TS or SPM. An important implication of this figure is that risks of 3C global warming under low vulnerability are judged to be similar to risks of 1C global warming under high vulnerability. Hence the risk can be reduced by either/both reducing the level of climate change and reducing vulnerability. (Richard Betts, Met Office Hadley Centre)	The reviewer is correct about the relationship of the likely range of projected GMT outcomes relative to the location of the illustrative plots of SRES-based outcomes. However the lines representing SRES outcomes are meant to be illustrative only, and representative of a hypothetical single study (which may not be based on the most likely SRES climate change outcome), so we retain the current positioning. We have checked with the lead author of the previous burning embers figure who confirmed that an assumption of medium vulnerability is accurate. We agree with the reviewer's view on the implications of this figure for conclusions about approaches to reducing risk.
966	81436	19	92	0	0	0	Figure 19-6: It is not entirely clear what is the main take away message of this figure. Further explanation should be required to be effective visual aid. (Yuka Estrada, IPCC WGII TSU)	We have clarified the text and caption explaining this figure.

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967	83067	19	92	0	0	0	Figure 19-6. Please see my comment on the previous figure for ideas on how to populate a simple version of this figure with real data. (Katharine Mach, IPCC WGII TSU)	We appreciate the ideas but have decided that the literature does not yet support using real data to effectively assess one of the RFCs in this fashion.
968	66320	19	92	0	92	0	Figure 19-6: Nice figure and explanation, though it would be helpful to indicate what type of development pathway might resemble the embers (could this be SRES A1B or B2 or some other non-SRES pathway?) (Timothy Carter, Finnish Environment Institute)	We have made clear in the text that the embers are assumed to represent a middle-of-the-road development pathway, but prefer not to get into arguments about which specific scenarios would be included in such a category.
969	80948	19	92	0	92	0	Figure 19-6 The figure is useful but it needs to provide more information on data and additional future pathways. (Monalisa Chatterjee, IPCC WGII TSU)	We indicate in the text that in the future when there is more literature available we could employ more impact assessment results to improve this figure.
970	58961	19	93	0	0	0	Image resolution of Figure 19-7 is very bad: maybe should be improved? (EVELYNE FOERSTER, BRGM)	This figure has been deleted.
971	62726	19	93	0	0	0	Figure 19-7; The lower range of verticle axis should be expanded because the estimates by FUND model cannot been seen well. (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE))	This figure has been deleted.
972	78670	19	93	0	0	0	Figure 19-7: Could the negative part (positive impact) of the range for the FUND model be shown ? Does it takes into account the medium to long term consequences of sea-level change at, for example 4°C, or is it limited to 2100 ? (Philippe Marbaix, Université catholique de Louvain)	This figure has been deleted.
973	80949	19	93	0	93	0	Figure 19-7 the legend is confusing. It is not clear if the thin lines represent dashed line or if the colored patches represent the solid lines. The caption too needs to be uncluttered and easy to follow. The description about shaded regions should also be added to the legend. (Monalisa Chatterjee, IPCC WGII TSU)	This figure has been deleted.
974	80950	19	93	0	93	0	The caption needs to be simple and easy to follow. The use of grey line to show the 5-95% range needs to be highlighted. The last sentence about damages of 2.2% of GDP is difficult to see in the figure. I am assuming the upper section (+) is damages and lower section (+) is actually gain. Not clear if that is what was intended. (Monalisa Chatterjee, IPCC WGII TSU)	This figure has been deleted.
975	58962	19	94	0	0	0	Except for titles, legends in Figure 19-9 are difficult to read (too small) (EVELYNE FOERSTER, BRGM)	We have redrawn the figure and it will be brought up to publication quality by the TSU prior to final publication.
976	74218	19	94	0	0	0	Figure 19-9: Why are we including a table from ONE study based on ONE SRES scenario in a report cycle for which the RCPs provide key undepinning information? (UNITED STATES OF AMERICA)	We have included a second panel for a second SRES scenario. This study actually includes the output of several different research groups and is one of very few globla studies of avoided impacts. Therefore a figure showing a meta-analysis of all the studies is not possible, as this is really the only major study of this nature.
977	77785	19	94	0	0	0	Figure 19-9: Are both panels needed given that, in the absence of the discussion of details, both panels make essentially the same point. (Francis Zwiers, Pacific Climate Impacts Consortium)	We have revised the figure to create two different panels where one indicates the importance of the date of peaking of global emissions and the other the importance of baseline scenario.
978	78669	19	94	0	0	0	Figure 19-9: When referring to an impact, it seems very difficult to understand % changes between two scenarios. We should have the reference impacts, which are most probably available in the source publications. Otherwise we may compare, for example, the loss of 20% of a minor benefit on flooding risk in a region to a 30% worsening of a much more substantial impact elsewhere - this would not be very relevant. (Philippe Marbaix, Université catholique de Louvain)	We decided to retain the % changes for clarity, and space did not permit including figures of the reference absolute impacts.
979	80539	19	94	0	0	0	Figure 19-9 is extremely useful and important. The current draft only draws on 3 sources, 2 of which are by the same lead author, so for greater confidence I suggest trying to bring in other work. Some possibilities include: Wiltshire et al (2013, Sustainability), which indicates more of a trend towards global wetting than drying than Arnell et al (2012); Betts et al (submitted to Biogeosciences) which also shows a trend more towards wetting than drying but with a different climate model to Wiltshire et al, and; a set of papers under the Inter-Sectoral Impacts Model Intercomparison Project (ISI-MIP). (Richard Betts, Met Office Hadley Centre)	We would have liked to include the outputs of ISIMIP in this analysis but the results were not available in time for them to be included. We did however cite the ISIMIP papers that were publsihed immediately before our chapter was finalised.

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980	80540	19	94	0	0	0	Figure 19-10 sounds important but is not available for review in this draft. I suggest that discussion with lead authors of other chapters will therefore be critical. I will be happy to do this. (Richard Betts, Met Office Hadley Centre)	Thank you for the offer. We completed the figure and discussed it with a number of authors including those in WGIII.
981	83068	19	94	0	0	0	Figure 19-9. The blank bars at the top of each graphic should be clarified. Additionally, it would be preferable to adopt an approach to the visualization that better allows comparisons across the baselines, it would seem. Finally, within the caption, the metric of uncertainty should be specified. (Katharine Mach, IPCC WGII TSU)	We have removed the blank bars which were erroneous. We have created an additional panel to highlight a comparison across the baseline as you have suggested.
982	84415	19	94	0	0	0	Figure 19-9: This figure is rich in detail, but is hard to interpret in its current form. I would strongly suggest considering ways to improve its clarity. For example, the differences due to the choice of baseline (comparing the two panels) are hard to pick out due to the greater number of categories under the A1B baseline and the difference in scaling of the x axes. I would suggest a common x axis for both, and either making sure the categories for which results are available under both A1B and A1FI are lined up horizontally, or considering merging the two sets, presenting both baselines for a given category adjacent vertically. This latter suggestion would also facilitate grouping the categories by "sector," as I feel it would be clearer to see all the energy-related categories together, all the water-related, all the ecosystem-related, etc. Some categories would have two bars (A1B, A1FI), some would have one. In addition, I realize that these percentages are not fractions of equivalent total impacts under the two baselines, which is another element that is not clear at this stage. The author team should consider whether a direct comparison of changes of different magnitudes in percentage terms is clearest, and whether it should be paired with an indication of the actual quantitative change in each category, which would also illustrate the differences in the magnitude of impacts and impacts avoided under the two baselines, as well as the spread across climate models indicated by error bars. (Michael Mastrandrea, IPCC WGII TSU)	We agree, we have completely redrawn this Figure. The left panel now shows clearly the effects of baseline so that this can be directly examined without being confused by the differect impacts sectors for which data was available. The other panel shows additional information relating to the influence of the peaking date of emissions, which we highlight in the text and this seemed to us to be a good use of the second panel which we would otherwise have removed. It is also a very policy relevant piece of imformation. We considered your suggestion to group the categories, but decided to order them instead in order of decreasing avoided impacts. The figure caption makes clear what is actually shown in terms of % impacts avoided relative to the two different baselines. Having decided that we wanted to show both the panels in the new version, we decided that it would confuse matters if we showed the magnitude of avoided impacts also,although this information is actually included in one of our publications.
983	66321	19	94	0	94	0	Figure 19-9: Why are estimates for a different set of impacts under the two scenarios? This means that the figures are not aligned making comparison difficult of those impacts that are in common across the scenarios. The text labelling is pretty illegible as well! (Timothy Carter, Finnish Environment Institute)	Please see response to comment 982. Additionally, the figure quality will be brought up to specification by the TSU for the final publication.
984	67902	19	96	0	0	0	Figure 19-6: This concept is very important and should not be removed from here. Especially the information that lower vulnerability can reduce the risks at higher temperature is very informative. Therefore, please cite and explain the idea in SPM and TS. (JAPAN)	We can pass along your suggestion but what appears in the SPM is not our decision.