#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
1	38474	19	0	0	0	0	Only a very few statements in the chapter are associated with confidence or likelihood statements (nearly always in italics). Where they are given, it is not clear if these were arrived at by the chapter authors or by the authors of the cited studies. Presumably some of the assessments were made using earlier uncertainty guidance rather than the new IPCC guidance developed for AR5. Where confidence/likelihood statements are not given, it is not clear whether this is impractical, or confidence would be very low etc etc. (Claire Goodess, University of East Anglia)	We have added many confidence and likelihood statements
2	38475	19	0	0	0	0	A large number of the cited references do not seem to be listed in the reference list. (Claire Goodess, University of East Anglia)	References and citations will be coordinated better in next draft.
3	39881	19	0	0	0	0	My biggest concern with this chapter is presentation/accuracy of the text. Some references are in alphabetical order, others in chronological order and others in a random order. More worryingly, several of the references I wished to follow up don't appear in the reference list. There is inconsistent italicisation of et al.. For consistency, other Latin words used in an English sense (e.g. per, via, sensu, ceteris paribus) need to be in italics as well; there is an annoying mixture of American and British English; '&' and 'and' are used interchangeably, as is CO2 - subscript 2- and CO2; O2 - subscript 2- and O2, and N2O - subscript 2- and N2O. I know that as reviewers we are asked not to flag these types of issue, but reporting them is part of the review process: I would not expect to see these problems to this extent in a document of this type and at this stage and their presence makes the task of reviewing the text much harder as they detract from the scientific message. (Peter Burt, University of Greenwich)	These will be corrected in succeeding drafts.
4	41200	19	0	0	0	0	This chapter was well written and does an excellent job of assessing recent literature, presenting the linkages between human and natural systems (i.e. integrates social-ecological systems into the discussion), and how this inter-dependency comes into play when defining key vulnerabilities and emergent risks. (Susan Evans, WWF-Canada)	Thank you.
5	41569	19	0	0	0	0	The authors are to be commended for taking this draft chapter to what is now a quite-polished state, from a previous zero-order draft about which I had some concerns. My main observation is that the conclusions do not yet bring to the surface: What ARE the (say, top 5 or top 10) main risks GLOBALLY? Which are the regions/places most at risk? And...Knowing that these KVs are often dependent on syndromes or nexi of underlying conditions (eg development), what are the main things that can be done to REMOVE/AVOID these KVs by altering these conditions (eg development)?. I believe that readers would expect these conclusions to be in the Executive Summary (of course, any list would have many conditionalities); and these conditions are important to summarise in themselves (ie what effects KV most) (Martin Parry, Imperial College)	Thank you for pointing this out. We have brought forward many key conclusions to the ES, and emphasized them more in the text.
6	41570	19	0	0	0	0	Is not a key question: How do these key risks/vulnerability due to CC COMPARE WITH OTHER (NON-CC) RISKS. Somehere in the AR5 Assessment this issue ought to be addressed (in this chapter, or ch 1 or chapter 2). There are quite well-developmed methods for COMPARING UNLIKE risks (eg National Risk Registers that OECD countries have developed; the WEF global risks project, etc). (Martin Parry, Imperial College)	While there is certainly merit in this suggestion, it is outside the purview of Chapter 19.
7	43079	19	0	0	0	0	Do you really need the expression "indirect, trans-boundary, and long-distance impacts .."? What is meant by that can't you find some other wording in the structure of the chapter? That might help understanding the chapter. (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	We believe this wording is both compact and precise and cannot think of a better alternative
8	43362	19	0	0	0	0	The chapter presents a lot of useful information. The discussion of emergent risks is particularly innovative and relevant. At the same time, the chapter suffers from confusing definitions of (key) vulnerabilities and risks in different places (see below), and from the lack of a clear summary figure. (Hans-Martin Füssel, European Environment Agency)	We have improved consistency between definition and terms used throughout the text. We have also added additional figures to illustrate key concepts, and made figure 1, a key figure, more transparent.
9	43363	19	0	0	0	0	TERMINOLOGY AROUND KEY RISKS AND VULNERABILITIES (PART 1) The terms (key) risks and (key) vulnerability/ies are defined (and used) inconsistently in different parts of the chapter, such as the Executive Summary (p. 2), Figure 19-1, Box 19-2 and Section 19.2.2. This leads to lengthy, and at times contradictory methodological sections that may not all be relevant for the interpretation of the results presented in this chapter (essentially in Table 19-3). After reading the whole chapter, my (sympathetic) interpretation of the situation is as follows: The chapter was assigned a title (by the IPCC Plenary) that uses the same term "Key vulnerabilities" as in the AR4 (where it also created heated discussions with several reviewers). Use of the word "vulnerability" in this context implied the TAR/AR4 "end-point/integrative" definition of vulnerability, which includes sensitivity, exposure, and adaptive capacity. The authors of the AR5 chapter, however, generally use different definitions of vulnerability and risk, which are based on natural hazards research and the social sciences. Those definitions distinguish clearly between exposure to physical impacts and the (internal) vulnerability of people, communities and ecosystems. Those definitions of vulnerability and risk were first used consistently in the IPCC SREX. Not the title uses the pre-SREX IPCC definition of vulnerability, the text generally uses the (different!) SREX definition of vulnerability, and the definitions of key terms are ambivalent. The specific problems of the current draft are as follows: * The definition of "key risks" in the Executive Summary (p. 3, ll. 1-2) and in Box 19-2 (p. 7, ll. 5-10) as arising from "high physical impact *or* high vulnerability of societies" appears incorrect. In my view, a "key risk" requires a physical impacts *and* someone/something vulnerable to it; one of those characterisitcs is not sufficient. * The definition of "key vulnerabilities" in the Executive Summary (p. 3, ll. 8-11) as "arising from one or more of the following characteristics" appears incorrect. According to that definition, any "exposure to phyiscal climate changes" would qualify as "key vulnerability", which is far too loose definition. * The short definition of "vulnerability" in Box 19-2 (apparently taken from the SREX) is not consistent with the definition of "key vulnerability" in the Executive Summary. * The definition or "risk" in Box 19-2 (p. 6, ll. 47-50) applies an anthropocentric perspective (focussing on "lives, livelihoods, health status" etc. whereas the application of "key risks" in Table 19-3 applies a wider perspectives that includes risks to ecosystems (even if they are not used by humans). Such a wider perspective is backed by UNFCCC Article 2, as highlighted in the definition of "key risk" in Box 19-2 (p. 7, ll. 5-10). (Hans-Martin Füssel, European Environment Agency)	We have worked hard to gain consistency throughout the SOD.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
10	43364	19	0	0	0	0	TERMINOLOGY AROUND KEY RISKS AND VULNERABILITIES (PART 2) My recommendations are as follows: * Each relevant term should be defined only once, in Box 19-2. No definitions should be included in the Executive Summary. * It should be made explicit that the use of the terms vulnerabiltiy and risk in this chapter is in line with the SREX, and thus differs significantly from the use in the AR4 (and TAR). As a consequence, the term "key risks" in AR5 language is essentially the same as "key vulnerability" in AR4 langauge. (I assume it is no longer possible at this stage to change the title of the chapter in order to reflect the updated interpretation of the term vulnerability.) * It should me made clear that the central terms in this chapter are key risks and emergent risks (whereas the central term in the corresponding AR4 chapter was "key vulnerabilities"). In order to reduce the risk (sic!) of confusing the reader, I propose to use the term "key vulnerability" only in a historic context when referring to the AR4. Using the terms "Key risks", "Emergent risks", "physical impact" and "vulnerability" appears sufficient from a scientific perspective. * If the authors believe that active use of the term "key vulnerability" cannot be avoided in this chapter, they should define "key risks" first and "key vulnerability" in relation to "key risks" (as is done on p. 7, ll. 12-16 but not on p. 3, ll. 8-11). Those criteria used to identify "key vulnerabilities in the AR4 (now listed in Section 19.2.2.1) that are relevant for identifying "key risks" should be included there (in Section 19.2.2.2). If a "key vulnerability" criterion from the AR4 is not relevant for identifying "key risks" in this chapter, it does not warrant a lengthy discussion here. (Hans-Martin Füssel, European Environment Agency)	We disagree: key vulnerabilities are important to understanding the primary factors underlying risk (which then facilitates remediation). In any event, this is a pillar of the chapter as requested by the PAO.
11	43383	19	0	0	0	0	I reiterate my view expressed in the ZOD review that one of the most important achievements of this chapter is the clarification of the vulnerability and risk concepts and terminology, and harmonization with other concepts that are prevailing. Given that previous AR's had a different (and somewhat ambiguous) approach I consider that a major point. I also think the chapter is consistent througout the text with the concept outlined at the beginning. There is rich material in the chapter and I can't see a major point with regards to key vulnerabilities, RFC's and emergent risks that was missed. However, I think the figures are not up with the level of the text and clearly need improvement (possibly, the authors had not enough time to sketch a few comprehensive and synthetic figures or had other reasons not to do so). I strongly suggest to include a few additional figures that show a synthesis of at least some part of the text. In the TAR we had the RFC/'burning amber' diagram, later updated by Smith et al. 2009, and the authors of this chapter chose not to update this figure, which might be a reasonable decision. Instead, Fig. 19-7 is presented. I like that figure because it is instructive in showing the importance of vulnerability for risks, given different temperature rises, but other than that it is pretty meaningless (if it is decided to keep that figure, I suggest to indicate 'low' and 'high' vulnerability on the x-axis, just for clarification). A few suggestions for additional synthesis figures: a world map showing locations / regions of key vulnerabilities, RFC, emergent risks. I would really expect such a figure from chapter 19 even though it might not be trivial to sketch it. A conceptual figure showing a sort of risk network for one or more than one specific topics, illustrating how vulnerabilities, impacts and risks are connected for that topic (and possibly geographic region). I also noted that many references in the text are missing in the literature list. (Christian Huggel, University of Zurich)	We have added new figures on hotspots and distant, indirect risks to accommodate these concerns.
12	43788	19	0	0	0	0	Referring to the Chapter´s objective to assess new methodologies for categorising key vulnerabilities, the recent identification of typical patterns of vulnerability is such a new approach (Jäger et al. 2007, Kok et al. 2010, Sietz et al. 2011a, Sietz et al. 2011b). These analyses categorise the multiple dimensions of vulnerability in a set of socio-ecological systems. The proposed cluster approach presents one way of dealing with the complex vulnerability-creating mechanisms to multiple exposures. This approach is useful to understand functional similarities and differences from a broader perspective, however reflecting a sub-national resolution. The resulting typical patterns of vulnerability are less general than a major, all-embracing theory, but apply to more than one individual case. The studies characterise vulnerability at global scale, for example identifying hotspots of vulnerability in global drylands (Sietz et al. 2011a) as well as at local scale, for example considering smallholder production systems in southern Peru (Sietz et al. 2011b). Thereby, the global dryland analysis is the first attempt to quantitatively analyse dryland vulnerability sub-nationally and with global coverage. The results are validated by selected case studies reflecting the cluster-specific mechanisms and their spatial distribution. REFERENCES: Jäger, J., Kok, M., Mohamed-Katerere, JC., Karlsson, SI., Lüdeke, MKB., Dabelko, GD.,Thomalla, F., de Soysa, I., Chenje, M., Filcak, R., Koshy, L., Long Martello, M.,Mathur, V., Moreno, AR., Narain, V. and Sietz, D. (2007) Vulnerability of peopleand the environment: Challenges and opportunities. In: Global EnvironmentOutlook: Environment for development (GEO-4). UNEP, Progress Press, Valletta,Malta, pp. 301-360. ------ Kok, M., Lüdeke, MKB., Sterzel, T., Lucas, PL., Walther, C., Janssen, P., de Soysa, I., Tekelenburg, T., Sietz, D. and Brighenti, J. (2010) Quantitative analysis of patterns of vulnerability to global environmental change. Netherlands Environmental Assessment Agency, Potsdam Institute for Climate Impact Research, Norwegian University of Science and Technology. ------ Sietz, D., Lüdeke, MKB. and Walther, C. (2011a) Categorisation of typical vulnerability patterns in global drylands. Glob. Environ. Chang. 21: 431-440. ----- Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2011b) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Reg. Environ. Chang., Published online: 15 November 2011, DOI: 10.1007/s10113-011-0246-5. (diana sietz, Wageningen University)	We have now cited some of this work.
13	43926	19	0	0	0	0	The key vulenerabilities related to Ch 6 "Ocean systems" are not well addressed (Muhammad Amjad, Global Change Impact Studies Centre)	We are limited here to use the input given Chapter 19 by Chapter 6
14	43927	19	0	0	0	0	The key vulenerabilities and emergent risks due to geoengenring are not addressed (Muhammad Amjad, Global Change Impact Studies Centre)	These are addressed in section 19.5.4
15	44527	19	0	0	0	0	Many unspecific references to WGI AR5 or to SREX. Please cross-reference accurately to the specific chapters. (Thomas Stocker, IPCC WGI TSU)	These lines-of-sight have been improved.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
16	44528	19	0	0	0	0	Executive Summary: Please ensure that the statement provided in the second to last bullet ("For example, no model-based scenarios in the literature demonstrate the feasibility of limiting warming to a maximum of 1.5 C with at least 50% likelihood") is based on and consistent with the WGI AR5. (Thomas Stocker, IPCC WGI TSU)	This statement has been clarified by indicating that "no integrated assessment model-based scenarios" in the literature demonstrate this feasibiliy. The conclusion is essentially about technological feasibility, not about climate response, so does not directly follow from WG1 Ch 12. However the climate responses assumed in mitigation studies are broadly consistent with those assessed in Ch 12.
17	44529	19	0	0	0	0	Section 19.3.2.1: Statement "projected effects of climate-change induced increases in extreme events such as drought and increased forest losses due to fire" – please add reference to SREX and/or WGI AR5 and ensure consistency with latest WGI AR5 assessment. (Thomas Stocker, IPCC WGI TSU)	We have gone carefully through the draft and cited WGI text on phsycial science statements, assuring consistency with WGI SOD
18	44530	19	0	0	0	0	Section 19.3.2.1: update reference "X-ref WGI" to Chapter 6, WGI AR5. (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
19	44531	19	0	0	0	0	Section 19.3.2.2.1: statement that climate variability is projected to increase ("The projected increase in climate variability…") is not backed up with a reference and it is too general and not consistent with the SREX Chapter 3 or the WGI AR5 assessment. (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
20	44532	19	0	0	0	0	Section 19.3.2.3: Avoid generalizing statements such as this p. 17, l6 , with regards to tropical cyclones/floods. Specific reference should be made to Ch3 of SREX or the SREX SPM in support of a more specific and useful statement. In addition, statements might need to be updated based on the latest assessment in WGI AR5. (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
21	44533	19	0	0	0	0	Section 19.5.1: could add reference to WGI AR5 for most recent assessment of temperature projections, or, at least, put results based on earlier ARs/scenarios into context with most recent IPCC WGI assessment (see, e.g., Section 19.5.2 on ocean acidification which cites WGI Ch3 throughout). (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
22	44534	19	0	0	0	0	Section 19.5.4 on Geoengineering: This material needs to be based on WG1 AR5 assessment of the physical science basis (see Ch6/7 of WGI AR5) – must avoid reassessing this material here in WGII (see, e.g., Figure 19.3). (Thomas Stocker, IPCC WGI TSU)	This section was entirely rewritten to conform with WGI chapters.
23	44535	19	0	0	0	0	Section 19.6.1.3.1: p33, line 25ff: statement "Extreme heat events, characterized by consecutive days with abnormally high temperatures, are increasing in frequency, intensity, and duration (IPCC SREX 2012)" needs be consistent with actual SREX wording and definition. See SREX SPM and SREX chapter 3. (Thomas Stocker, IPCC WGI TSU)	wording aligned with WGI SOD 11.3.2
24	44536	19	0	0	0	0	Section 19.6.3: careful checking of consistency with WGI AR5 is needed for reported physical science changes to avoid discrepancies in what is reported within the overall AR5 (extreme events in section 19.6.3.2; Large-scale Singular Events in Section 19.6.3.5; as indicated by several "to be updated based on WGI SOD"). For example, the statement on Greenland ice sheet loss (p. 42, l. 52), must be based on WGI AR5Chapter 13 and its assessment of multiple-lines of evidence, and not on a single study as currently done in the text. (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
25	44537	19	0	0	0	0	Section 19.7.1: refer to Ch12 WGI AR5 as the basis when discussing long-term changes and stabilization (p44, l37ff). (Thomas Stocker, IPCC WGI TSU)	citation added
26	44538	19	0	0	0	0	Section 19.7.2.1 Limits to mitigation: refer to WGI Ch12 for the allowable emissions and climate target discussion. (Thomas Stocker, IPCC WGI TSU)	Since this section is about the means to atttain certain trajectories, and since policy and economic jusgments are involved, we think a citation of WGI would be inappropriate.
27	44539	19	0	0	0	0	Section 19.7.3 Avoiding Thresholds, Irreversible Change, and Large-Scale Singularities in the Earth System: 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. (Thomas Stocker, IPCC WGI TSU)	see response to comment 17
28	44540	19	0	0	0	0	Table 19.3: 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. (Thomas Stocker, IPCC WGI TSU)	we have edited for consistency
29	44541	19	0	0	0	0	Figure 19.3 and Geoengineering impacts on the physical environment are assessed in detail in WGI AR5 Ch6 and 7. Add reference rather than reassessing the science. (Thomas Stocker, IPCC WGI TSU)	see response to comment 22

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
30	44740	19	0	0	0	0	An emergent risk that needs to be added to this chapter is that of nuclear war. New work on this topic has been published since AR4 and needs to be assessed. This is a potential risk, but unlike geoengineering, the technology actuallyt exists today to produce this dangerous anthropogenic interference with the climate system. Therefore it is even more relevant and germane than geoengineering. This new work has shown that the United States and Russia still have enough weapons to produce a full nuclear winter, with temperatures plummeting below freezing in the summer from the effects of smoke from targets, that a regional war, say between India and Pakistan, could produce climate change unprecedented in recorded human history, and that the effects would last for more than a decade. This regional war could also produce a global ozone hole, with enhanced UV and skin cancer at the surface. The work has been published in major journals, including Science, Nature, PNAS, JGR, and ACP. This topic is also being addressed for the first time by WG I, in Chapter 8. Here are the papers that need to be assessed. PDF files of the papers are available at http://climate.envsci.rutgers.edu/robock/robock_nwpapers.html and at http://climate.envsci.rutgers.edu/nuclear/ Mills, Michael J., Owen B. Toon, Richard P. Turco, Douglas E. Kinnison, and Rolando R. Garcia, 2008: Massive global ozone loss predicted following regional nuclear conflict. Proc. National Acad. Sci., 105, 5307–5312. Özdoğan, Mutlu, Alan Robock, and Christopher Kucharik, 2012: Impacts of a nuclear war in South Asia on soybean and maize production in the Midwest United States. Climatic Change, doi:10.1007/s10584-012-0518-1, published online but not yet in print. Robock, Alan, 2010: Nuclear winter. Wiley Interdisciplinary Reviews: Climate Change, 1, 418-427. (Invited paper) Robock, Alan, 2010: New START, Eyjafjallajökull, and Nuclear Winter. Eos, 91 (47), 444-445, doi:10.1029/2010ES003201. Robock, Alan, 2011: Nuclear winter is a real and present danger. Nature, 473, 275-276. Robock, Alan, Luke Oman, Georgiy L. Stenchikov, Owen B. Toon, Charles Bardeen, and Richard P. Turco, 2007a: Climatic consequences of regional nuclear conflicts. Atm. Chem. Phys., 7, 2003-2012. Robock, Alan, Luke Oman, and Georgiy L. Stenchikov, 2007b: Nuclear winter revisited with a modern climate model and current nuclear arsenals: Still catastrophic consequences. J. Geophys. Res., 112, D13107, doi:2006JD008235. Robock, Alan, Owen B. Toon, Richard P. Turco, Luke Oman, Georgiy L. Stenchikov, and Charles Bardeen, 2007c: The continuing environmental threat of nuclear weapons: Integrated policy responses needed. EOS, 88, 228, 231, doi:10.1029/2007ES001816. Robock, Alan, and Owen Brian Toon, 2010: Local nuclear war, global suffering. Scientific American, 302, 74-81. Robock, Alan, and Owen B. Toon, 2012: Self-assured destruction: The climate impacts of nuclear war, Bull. Atomic Sci., in press. Toon, Owen B., Richard P. Turco, Alan Robock, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, 2007: Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism. Atm. Chem. Phys., 7, 1973-2002. Toon, Owen B., Alan Robock, Richard P. Turco, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, 2007: Consequences of regional-scale nuclear conflicts. Science, 315, 1224-1225. Toon, Owen B., Alan Robock, and Richard P. Turco, 2008: Environmental consequences of nuclear war. Physics Today, 61, No. 12, 37-42. Xia, Lili, and Alan Robock, 2012: Impacts of a nuclear war in South Asia on rice production in mainland China. Climatic Change, doi: 10.1007/s10584-012-0475-8, published online but not yet in print. (Alan Robock, Rutgers University)	After careful consideration we have decided not to include assessment of risks from nuclear war in this chapter, for two reasons. First, the chapter is about key risks defined as those relevant to interpretation of Article 2 of the UNFCCC, and we don't believe that nuclear war meets that test. Nuclear war is neither an emergent nor emerging risk, according to the chapter 19 definition. Second, there is little coverage of this topic in WG1; it is limited to a brief mention as part of a section on volcanic anlogues to geoengineering.
31	44816	19	0	0	0	0	Congratulations on a well-prepared early draft. The logic is clear, key terms are clearly defined and the material is well situated in relation to prior reports. The emerging risks chosen are timely and interesting. (Carol Hunsberger, Institute of Social Studies)	Thank you.
32	46954	19	0	0	0	0	The chapter focuses on risks that are emergent in the literature; however, that Arctic sea ice has melted more quickly than predicted in AR4 is a clear example of a large scale discontinuity or tipping point that has already been crossed. The change in surface albedo associated with this melting suggests that this will increase the likelihood of the crossing of further tipping points. As per the UNFCC, this clearly mandates calls for much greater application of precaution - in particular in regards to mitigation. The Arctic sea ice melt tipping point is not 'in the literature' it exists in the physical world and gives clear indication that previous ARs conservatism in favour of business as usual is outmoded and dangerously complacent. There are numerous other cases where empirical observation suggests that multiple tipping points may be crossed before AR6 is in a position to rectify this omission. Given the intrinsically optimistic tone of economic policy advice in AR5, greater overall balance would be brought about by making a precautionary call strong, clear and highly visible. See my comments on earlier chapters for some further logic behind this comment. (Mark Charlesworth, Keele University)	Arctic sea ice threshold is covered in 19.6.3.6 and 19.7.3. Whether this phenomenon is a tipping point by the definition used here is not at all clear.
33	46955	19	0	0	0	0	There is too great an assumption that the probability of hazards being realised can be attributed valid numbers. The difficulties of this are clear from Charlesworth M & Okereke C, (2010, Policy responses to rapid climate change: An epistemological critique of dominant approaches, Global Environ. Change, 20:121-129, doi:10.1016/j.gloenvcha.2009.09.001) along with various examples in the draft AR5 chapters. Those with practical experience of relatively simple contained risk assessments e.g. product FMEA's can testify that hazards are realised that were not anticipated despite thorough and detailed risk assessment - the number of automotive product recalls provides sufficient evidence for this. (Mark Charlesworth, Keele University)	This issue is discussed in 19.7.3. The interactions selected are based on expert judgment of the authors on which are likely to become key risks, as indicated in 19.1 and elsewhere.
34	48048	19	0	0	0	0	The work on criteria on key and emerging risks is admirable, and much needed. Interactions with multiple stresses are critical and well developed. Are there selection criteria for interactions subsections? If so, it would be good to have an introductory paragraph. The last two sections 19.6 and 19.7 may overlap with other chapters, and seem to be more descriptive and introductory than other parts of the chapter. (So-Min Cheong, University of Kansas)	We now indicate places where choices reflect expert judgments by AR5 authors

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
35	48120	19	0	0	0	0	Chapter 19: This chapter is important and contains a lot of useful material, but appears to require further development. In particular, the subsection updating the RFCs is very useful, but unfortunately ends the whole 19.6 with a theoretical explanation of its limitations - that variations due across socio-economic pathways are not taken into account. At the time of TAR, the RFCs were a welcome innovation by the IPCC authors; I feel that it is time to innovate again : provide a new (partly) quantitative summary of the links between key risks, levels of climate change, and socio-economic scenarios. This could be in relation with RFCs or presented in a different way, such as the examples provided in AR4 in relation to climate change (AR4 Table 20.8). A full discussion including the new SSPs may be out of reach, but some simplified presentation that considers various socio-economic pathways (or vulnerability levels, with the new definition of vulnerability) would be much welcome, and would most likely contribute to a policy relevant discussion of issues related to article 2. (Philippe Marbaix, Université catholique de Louvain)	In 19.6, we have gone as far along this direction as the current litreature allows. Unfortunately, there is a paucity of discussion of impacts in the context of future changes in vulnerability associated with particuarl SSPs.
36	48138	19	0	0	0	0	There is need to balance the statements on climate change and violent conflict in Chapters 12 and 19. While Chapter 12 is more cautious regarding the results of empirical studies, Chapter 19 makes stronger claims which are partly based on a yet unpublished source (Hsiang & Burke 2012). In addition two peer reviewed publications (Scheffran et al. 2012 in Science and a comprehensive volume by the same authors) could be cited here that provide further results based on literature reviews (see references below). (Jürgen Scheffran, University of Hamburg)	Text has been edited to align with and rely largely on Chapter 12 literature review and assessment.
37	49154	19	0	0	0	0	Chapter 18 focuses on the attribution related to changes in the past. Attribution of impacts related to projected climate change should also be covered in the WG II report but is not for the moment. May be this should be located in ch 19. Suggest that you discuss with the other chapters where this should be dealt with. (Oyvind Christophersen, Climate and Pollution Agency)	We appreciate the suggestion and have followed up with coordination.
38	51066	19	0	0	0	0	1) Overall -- In preparing the 2nd-order draft, the chapter team should prioritize making each section of the chapter a polished, comprehensive treatment of topics considered. From these sections, the chapter team is then encouraged to maximize the utility of its findings, ensuring that they are robust, compelling, and nuanced. Themes to consider informing in constructing findings include decisionmaking under uncertainty, risks of extreme events and disasters, avoided damages, and limits to adaptation. To these ends, the chapter team has prepared a solid 1st-order draft. In an effort to inform further chapter development, I provide general and specific comments below. (Katharine Mach, IPCC WGII TSU)	Thank you for these suggestions, which we have incorporated in the SOD.
39	51067	19	0	0	0	0	2) Highlighting key findings -- In developing the 2nd-order draft, the chapter team should aim to further highlight key findings throughout the sections of the chapter, using calibrated uncertainty language to characterize its degree of certainty in these conclusions. In this way, the reader of the chapter will be able to understand how the literature reviews and syntheses in the chapter sections--the traceable accounts--support the conclusions of the chapter, especially those presented in the executive summary. (Katharine Mach, IPCC WGII TSU)	See response to comment 38. Key findings are now highlighted more emphatically. Uncertainty language is used more and aligned with IPCC practice.
40	51068	19	0	0	0	0	3) Usage conventions for calibrated uncertainty language -- Where used, calibrated uncertainty language, including summary terms for evidence and agreement, levels of confidence, and likelihood terms, should be italicized. In addition to incorporating these terms directly into sentences, the author team may find it effective to present them parenthetically at the end of sentences or clauses. Casual usage of the reserved uncertainty terms should be avoided, as has been flagged in some specific comments throughout the chapter. (Katharine Mach, IPCC WGII TSU)	See repsonse to comment 39.
41	51069	19	0	0	0	0	4) Cross-references to other chapters -- Where chapter 19 references other chapters, it would be preferable to reference the relevant sections of those chapters, not just the whole chapters, in order to enhance traceability for the reader. (Katharine Mach, IPCC WGII TSU)	We began to implement this suggestion in the SOD and will complete this in the FGD.
42	51070	19	0	0	0	0	5) Specificity of described observations and projections -- The chapter team should continue ensuring specificity, paired with conciseness, in describing observed and projected impacts, especially in the context of characterizing projected outcomes relevant to emergent risks and key vulnerabilities, impacts, and risks. (Katharine Mach, IPCC WGII TSU)	See response to comment 41, and particularly the revisions of 19.6.3.
43	51071	19	0	0	0	0	6) Conditional constructions -- The chapter team has done a nice job of using conditional constructions that especially separate physical changes from corresponding conditional outcomes. The chapter team is encouraged to continue using such constructions, also separately characterizing the degree of certainty for physical changes and conditional outcomes where appropriate. (Katharine Mach, IPCC WGII TSU)	Thank you for this comment.
44	51072	19	0	0	0	0	7) Figures -- Figures represent an important and effective vehicle for communication in the context of assessment. The chapter team strongly encouraged to continue developing figures to complement assessment in the chapter text. (Katharine Mach, IPCC WGII TSU)	The SOD will contain additional figures.
45	51073	19	0	0	0	0	8) Harmonization with the Working Group 1 contribution to the AR5 -- At this stage of chapter drafting, the author team should carefully consider the working group 1 contribution. Wherever climate, climate change, climate variability, and extreme events are discussed, the chapter team should ensure that their treatment is harmonized with the assessment findings of working group 1. (Katharine Mach, IPCC WGII TSU)	We have carefully aligned our statements with WGI including lines of sight.
46	52211	19	0	0	0	0	As a general impression, the chapter is so detailed that it is hard to get a good sense of the overall importance of climate change, and the threats from emergent risks. I'd suggest working on finding a way to better get the overall threat/risks more generally communicated. (Michael MacCracken, Climate Institute)	This is a very helpful comment which we have tried to implement.
47	53762	19	0	0	0	0	The chapter has obviously worked closely with other chapters in developing the FOD and such coordination will continue to be very important for a SOD that is consistent with the rest of the WGII report. (Kristie L. Ebi, IPCC WGII TSU)	Thank you for your comment.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
48	53763	19	0	0	0	0	The chapter might want to be more explicit about teleconnections. (Kristie L. Ebi, IPCC WGII TSU)	We are puzzled by this comment - do you mean atmospheric, meteorological teleconnections or indirect, distant effects? We don't see the relevance of the first, and the second is well-covered.
49	53764	19	0	0	0	0	There are a number of opportunities to include consideration of indigenous knowledge and vulnerabilities of indigenous communities. (Kristie L. Ebi, IPCC WGII TSU)	We rely on other chapters to provide us with such material. As a result, the current discussion, 19.4.3.1, is regrettably limited.
50	53765	19	0	0	0	0	The chapter is a bit uneven in considering issues from the perspective of developed and developing countries. (Kristie L. Ebi, IPCC WGII TSU)	We are not sure which way you consider the imbalance struck. We have tried to be balanced in the SOD.
51	53766	19	0	0	0	0	Please carefully check statements that imply attribution as to whether attribution has been established (e.g. observed climate change impacts and similar statements). (Kristie L. Ebi, IPCC WGII TSU)	Statements are checked carefully to align with WGI and WGII chapter 18.
52	53767	19	0	0	0	0	The chapter is uneven in stating baselines (e.g. warming of x degrees above what baseline) (Kristie L. Ebi, IPCC WGII TSU)	We have tried to remedy this problem.
53	53768	19	0	0	0	0	The definition of climate change used by the IPCC is not the definition used by the UNFCCC; it includes anthropogenic and natural climate change. (Kristie L. Ebi, IPCC WGII TSU)	We are not sure which page and line this comment refers to.
54	54466	19	0	0	0	0	GENERAL COMMENTS: I would like to thank the authors for a very interesting and enjoyable FOD. When considering the expert review comments received on your chapter and the next round of revisions, I suggest several overall priorities. (1) Keep in mind that the preparation of the SOD is the time to ensure that each section of the chapter presents a comprehensive treatment of relevant literature, and that the Executive Summary presents findings that capture the key insights that arise from the chapter assessment. (2) This is also the time to focus on distilling the chapter text, not just fine-tuning wording but editing with a critical eye to improving quality by making discussions succinct and synthetic, while still being comprehensive. (3) Cross-chapter coordination is also important at this stage, and the author team has clearly invested extensive effort in the preparation of a framework in this chapter to synthesize information across chapters on key risks, key vulnerabilities, and emergent risks. (4) Cross-Working Group coordination is important as well, and relevant chapter sections should cross-reference chapters from the other Working Groups, particularly in the case of statements about changes in mean or extreme climate conditions that are assessed in the contribution of Working Group I. (5) Continue to look for opportunities for the creation of figures that synthesize across results from the literature. (Michael Mastrandrea, IPCC WGII TSU)	We appreciate these suggestions.
55	54467	19	0	0	0	0	EXECUTIVE SUMMARY: Thank you as well for developing an initial draft of an Executive Summary for the FOD. For the SOD, the author team should focus on constructing assessment findings of the form employed by other chapters. Each paragraph should present an assessment finding in bold with calibrated uncertainty language, followed by additional nonbold sentences providing further explanation and context, as well as line of sight to supporting chapter sections where the traceable account appears. In the context of linking chapter text with Executive Summary findings, I would also suggest considering ways to explain the calibrated uncertainty language used in the Executive Summary in the corresponding chapter section(s) where the traceable account appears for each finding. For example, in situations where confidence in a finding is not high, it would be useful to understand why the author team has made this judgment--what are the factors that limit confidence. In situations where confidence is high and/or where likelihood language is employed, what is the evidence that forms the basis for these assignments. Succinct descriptions in the chapter text of this type will both highlight the basis for ES findings and help explain the author team's assessment of the literature. The TSU is available to discuss any of the technical details related to these issues if that would be of use. (Michael Mastrandrea, IPCC WGII TSU)	The ES has been entirely rewritten, and we appreciate this guidance in doing so.
56	54896	19	0	0	0	0	The author team should update the reference list and remove citation inconsistencies between in text citations and full citations given in the reference list. Please see supplementary document named WG2AR5-Chap19_Reference Checks.pdf at https://ipcc-wg2.gov/AR5/author/FOD/SuppMat (Monalisa Chatterjee, IPCC WGII TSU)	We have tried to remedy this problem.
57	49155	19	1	18	1	18	Minor detail; please include "Volunteer" in front of "Chapter Scientist" (Oyvind Christophersen, Climate and Pollution Agency)	This format issue will be decided by TSU.
58	44738	19	2	14	0	0	It's Geoengineering, and not "Geo-Engineering." It is not used with a hyphen in the literature. (Alan Robock, Rutgers University)	Correction made.
59	49156	19	2	14	2	14	Please replace "Geo-Engineering" with "Geoengineering" for consistency. This is also the case in page 3 line 45, page 26 line 11, and page 28 line 28. (Oyvind Christophersen, Climate and Pollution Agency)	see previous comment.
60	46982	19	2	49	0	0	Executive Summary. The statements within the Executive Summary need to have further explanation as in other chapters (seperating statement (bold) from explaratory text). (Stefan Kienberger, University of Salzburg)	Executive Summary completely rewritten.
61	51074	19	2	49	0	0	Executive Summary -- In subsequent work on the executive summary, there are several aspects of development for the author team to consider further: 1st, it would be preferable to present the paragraphs of the executive summary with a key finding in bold text followed by explanatory non-bold text. 2nd, for all of these statements, the author team should provide line-of-sight references to the supporting chapter sections. 3rd, for each key finding and wherever else relevant, the author team should use calibrated uncertainty language to characterize its degree of certainty in these conclusions, considering summary terms for evidence and agreement, levels of confidence, and likelihood terms. (Katharine Mach, IPCC WGII TSU)	See comment #60.
62	49157	19	2	49	4	30	The executive summary of chapter 19 should be more in line with what is current practise in previous IPCC reports and the other chapters. It should clearly present the major findings/results from the chapter, and consist of references to the appropriate section in square brackets. (Oyvind Christophersen, Climate and Pollution Agency)	See comment #60.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
63	49158	19	2	49	4	30	It is stated in the chapter that RFC might be used by policy makers for determining which impacts and vulnerabilities were key. While we find the chapter as such very informative and well written, the executive summary lacks concrete examples on key concerns that should be prioritized. (Oyvind Christophersen, Climate and Pollution Agency)	See comment #60.
64	49159	19	2	49	4	30	Description of emergent risks form the largest part of the chapter. While we agree that it is higly important to point out these risks, it is also crucial to highligte ways to respond to emergent and other (key) risks. We would therefor like to have response strategies better represented in the chapter, and in the executive summary. Inclusion of more examples of areas, populations, ecosystems at key risk are appreciated. (Oyvind Christophersen, Climate and Pollution Agency)	Response strategies are covered in detail in 19.7; but we are limited by the extant literature. We do bring some of these points I72 forward to ES.
65	48931	19	2	51	2	52	general comment - the chapter provides an understanding of risk & vulnerability produced by interactions b/w physical & socio-economic systems. It may be useful to explore 'tools' (such as scenarios) for identifying additional / contextual emergent risks / vulnerabilities. (Leon Soste, Department of Primary Industries, Victoria, Australia)	This issue is discussed in 19.6.3.1 and noted in the ES.
66	49821	19	2	51	4	30	Evolution is inevitable but you are so scared of it you have to assemble prejudiced opinion of its risks without trying to understand its potential benefits. (Vincent Gray, Climate Consultant)	Potential benefits of climate changes are noted in several places.
67	40820	19	2	53	2	53	Is there any scientific reason for selecting this particular value of 2° ? (Michel Petit, CGIET rue de Bercy)	The reason is given in 19.1, based on the UNFCCC process.
68	46979	19	3	1	3	11	Within these lines the key vulnerabilities and the key/emergent risks are being defined. It is recommended either to present also very shortly the overall risk framework here or provide a clearer indication on which framework the conceptual language is being built. This is somehow mentioned on page 3, line 13-15 but should be clearer in terms of language and conceptial 'positioning' (e.g. are the conceptual agreements on terms as lined out in the SREX report taken up?) (Stefan Kienberger, University of Salzburg)	Given SREX discussion, we did not want to repeat concepts in detail. However, we have tried to bring out the key concepts better.
69	52212	19	3	1	3	50	The material presented here just does not grab the reader's attention. In my view, all of this material should be put somewhere other than in the Executive Summary, and the Executive Summary should start with page 3, line 52 (Michael MacCracken, Climate Institute)	Agreed; ES totally rewritten.
70	46980	19	3	29	3	32	The sentence/this statement is not clear, especially the second part when it starts with "where the effects on human systems are increased..." does not come to a final conclusion. Please modify and provide a clearer statement. (Stefan Kienberger, University of Salzburg)	See response to comment #60.
71	53769	19	3	40	3	46	Please provide confidence statements. (Kristie L. Ebi, IPCC WGII TSU)	We have now done so.
72	40566	19	3	45	3	45	replace "geo-engineering" with "geoengineering" to ensure consistency and facilitate cross-referencing and text searches (David Santillo, Greenpeace Research Laboratories)	Done.
73	38253	19	3	45	3	46	Executive Summary. "Other emergent risks relate to ocean acidification, geo-engineering, temperature increases above 4°C, and indirect health impacts of high ambient concentrations of CO2." Comment: This '4°C' magnitude might be higher if we consider the following statement: "a warming of up to 2°C above 1990-2000 levels would result in significant impacts on many unique and vulnerable systems, and would likely increase the endangered status of many threatened species, with increasing adverse impacts (and increasing confidence in this conclusion) at higher temperatures." (Cf. lines 53-54 of page 3 followed by lines 1-2 of page 4). (Abdalah Mokssit, Direction de la Météorologie Nationale (DMN))	See comment #60.
74	52213	19	3	45	3	46	I do not think it really at all appropriate to have "geo-engineering" included in this list of very serious threats. First, I should say that to characterize ocean acidification, increases above 4 C, and indirect health impacts of high ambient CO2 concentrations as "other emergent risks" seems to me greatly underplaying their potential importance, especially the relatively high probability of their occurrence--these are serious threats (especially the first two) and this should be made clear. Regarding geo-engineering, aside from there being many, many types of geo-engineering (at this point, it has not been narrowed to global SRM), geo-engineering is of a totally different character in terms of the risk--it would be a choice to be made, and will presumably only be made after a detailed analysis that it would be the best approach, with many benefits. Listing it along with nearly inevitable risks of our present path seems to me totally inappropriate (as a recent Alan Robock opinion piece suggests, he thinks it is very unlikely to ever be done)--to get to a point for geo-engineering to be an emergent risk is just far too speculative at this point. I would also note that there is no mention at this point of the potential benefits (alleviated impacts) of geo-engineering and it makes no sense to be talking about the risks without talking about the benefits--it is certainly a difficult issue and an appropriate discussion could be included in this chapter, but listing it here is not at all the way to begin the discussion. And there should not be a discussion of geo-engineering generally before a discussion of its multiple forms--global SRM with its multiple approaches, regional SRM, CDR in its various forms, etc. (Michael MacCracken, Climate Institute)	The rationale for our focus on geoengineering is made clear in 19.5.4. That discussion of its impacts is emerging in the literature is without doubt true; the judgment that the emerging risk is severe enough to be potentially "key" is supported by the literature cited and by expert judgment of the chapter authors. The reasons for focusing on SRM in particular are now given, and we now rely on WGI chapters for physical science details, including placing it in context of all such methods, although we now include a brief discussion of this context. WGIII report is a more appropriate place to discuss benefits generally but we do mention them in 19.5.4, affording a more balance presentation.
75	46981	19	3	48	3	50	This statement reads different from the ones mentioned above. It somehow only refers to individual chapters, than making a clear statement which is specified later. The sentence on page 3, line 49 - 50 could be taken as the clear statement and further elaborated. (Stefan Kienberger, University of Salzburg)	See response to comment #60.
76	52214	19	4	8	4	11	This is a very important point to make. My understanding is that the California impacts study has found this to be a very important result--that is, the finer the detail of the analysis, the larger and more significant the adverse impacts that have been found. (Michael MacCracken, Climate Institute)	Thank you.
77	54331	19	4	20	4	21	The scope of impacts being considered here is unclear. Further, it is not clear whether this is simply a statement about the persistence or reversibility of these types of impacts, or whether other characteristics are being considered in this comparison. Further details would be helpful. (Michael Mastrandrea, IPCC WGII TSU)	See response to comment #60.
78	49160	19	5	26	5	26	Minor detail; the reference to SREX should be (IPCC 2012) (Oyvind Christophersen, Climate and Pollution Agency)	Corrected.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
79	46983	19	6	5	6	6	"over longer distances"; could this be added by 'larger areas' (distances is something 1-dimensional, as areas would be reflecting 2-D (3D)? (Stefan Kienberger, University of Salzburg)	Deleted
80	48122	19	6	29	6	34	The Cancun Agreements seem to have a stronger legal basis than the Copenhagen Accord - I would suggest citing Cancun instead of Copenhagen (or possibly refer to both, for historical reasons), with the appropriate text (Decision 1/CP.16, Section I, paragraph 4) (Philippe Marbaix, Université catholique de Louvain)	We aimed here for language which combined science and policy in the context of Article 2. Variants occur in the statements of all suceeding COPs after Copenhagen. Which has a stronger legal basis is not clear.
81	46987	19	6	40	7	53	If there are key risks with key impacts and key vulnerabilities, are there as well 'emergent' vulnerabilities and 'emergent' impacts next to emergent risks as well? Could be added or further clarified (Stefan Kienberger, University of Salzburg)	We could define progressively more refined terms but we think that elaborating the definitions of emerging and emergent further would only complicate what is now a straightofrward presentation.
82	45524	19	6	40	7	54	Box 19-2.Refers to Reasons for Concern, also C1 page 14 lines 1-42 and C 18 page 43 line 29 to page 44 line 39.Would be good to coordinate the text, to eliminate duplications and refers to the other sections of the AR5 .WG II contribution. (Avelino Suarez, Institute of Ecology and Systematic, Cuban Environmental Agency)	We have revised our discussion in a way which accomodates this concern.
83	48127	19	6	45	7	1	Definition of vulnerability This definition follows the SREX, and is thus different from AR4. As in the SREX, this should be clearly mentioned; however, the motivation given in the SREX SPM is not entirely applicable here : "reflecting the diversity of the communities involved in this assessment and progress in science, several of the definitions used in this Special Report differ...". Please provide an explanation of the differences between the old and the new definitions: the wording is very different, but to what extent is the substance also different? (Philippe Marbaix, Université catholique de Louvain)	These differences were noted in SREX so we do not feel they should be repeated here.
84	38476	19	6	47	6	50	Shouldn't this definition of risk also refer to vulnerability - e.g., see Figure 19.1. (Claire Goodess, University of East Anglia)	The definition of Impacts (and Consequences) which now precedes the definition of Risk links consequences to Vulnerability. We believe these four concepts are now firmly linked in the definition box.
85	48932	19	6	52	0	0	perhaps add a comment that the definition of risk provides the most meaningful results in the context of non-adaptive systems (Leon Soste, Department of Primary Industries, Victoria, Australia)	We are not sure how to address this comment.
86	40817	19	6	52	6	52	Does the "X" means an arrithmetic product or defines a two dimensions element ? Both are used. Inth e litterature (Michel Petit, CGIET rue de Bercy)	We have clarified that X represents multiplication.
87	46956	19	6	52	6	52	The definition of risk is only one and far too confident in human abilities to put numbers to climate phenomena - especially in the light of unimagined tipping points (Charlesworth M & Okereke C, 2010). (Mark Charlesworth, Keele University)	We provide both a general and quantitative definition and make clear that the quantititative one is a special case. Chapter 2 provided further clarity.
88	46984	19	6	52	6	52	The expressed formula does not represent what has been expressed in the written definition. Especially the term 'consequences' is unclear. In this case it is not clear how 'consequences' is being defined and how a link to vulnerability is being achieved. If the term consequences is used, it has to be defined within the definition box. In general it should also be thought if such a formula should be expressed. In general I am in favour of formally expressiong relationships, however, these formulas will be taken up the user community immediatly. If terms used in this formula are not defined properly, it will cause further confusion. Most importantly, the link to vulnerability is not sufficiently represented. Also linking to figure 19-1,risk would be defined as Risk=f(Probability physical impacts, vulnerability, exposure) (with this as an alternative proposition= Risk=f(Probability physical impacts, (vulnerability, exposure)). This is a critical issue, as confusion exists among the various definitions in different schools of thought. It is expected that the AR5 is consistent in this manner. (Stefan Kienberger, University of Salzburg)	See response to comment 84. We now believe that the definitions are closely linked so that the relations among impacts, consequences, vulnerability and risk are clear.
89	46985	19	7	1	7	3	It is proposed to cite "dangerous anthropogenic interference…" in the text (or even) provide a clarification/explanation on that. Otherwise it is not clear what should be clearly understood by this definition. An explantory text/example would help. This could be done in a similar manner as in the definition on key risks (page 5, line 5-10) (Stefan Kienberger, University of Salzburg)	The definition from the UNFCCC is as precise an explanation as is available. Further elaboration is found in Chapter 19 of AR4. The entirely of AR5 Chapter 19 is aimed at providing examples.
90	40816	19	7	1	7	16	Delete those lines : IPCC has always been very careful to avoid any implication in the definition af "dangerous", in the Article 2 of the UNFCCC. Key has a clear meaning in the usual language and does not require a definition. IPCC should not be involved in deciding whether or not a risk should be taken into consideration by a policy maker interested in artcle 2. Moreover these definitions are inconsistent with those of the Executive Summary, page 3, lines 1 to 11. (Michel Petit, CGIET rue de Bercy)	Inconsistencies have been eliminted. As to whether this chapter should assess what risks might be key, IPCC has been making such assessments since the TAR. The Plenary Approved Outline once again asked for our assessment of features which are "key"
91	46986	19	7	18	7	25	It is not that clear why this statement is included. This should be shortly explained. (Stefan Kienberger, University of Salzburg)	The statement is provided to explain, in historical context, the relation of this chapter, and particularly key vulnerabilities, to Article 2. We think its position in the text makes this clear.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
92	52215	19	7	27	7	30	Using geoengineering, even just SRM, as an example of SRM makes no sense to me at all--there is no plan to go ahead with it and suggesting that better understanding will identify its risks just makes no sense to me. There are quite a number of risks that are actually emerging given the situation that we are in--permafrost thawing leading to methane emissions, onset of more rapid loss of mass from ice sheets, and more. The example here should be about a real problem rather than a speculative one. In addition, Robock et al.'s study that shows a reduction in the monsoon is only one of the possible techniques and for an approach to application that makes virtually no sense and for which the other impacts would be much more severe. That is, Robock et al.'s study was for a sudden onset that would take the climate back to that of the 19th century from near its present state--who would even think to do that? First, such a sudden, emergency application would only be done if there were very serious other consequences that would be likely to be alleviated, so this would not likely be done for many decades into the future--so this example is just totally out of context for a very speculative and unlikely application. Second, it would seem much more likely that application of SRM would start out gradually, not suddenly. Third, what is not at all stated is that the potential application of SRM will be a comparative risk evaluation, of global warming with or without such an application; the discussion here is just incomplete and out of context, and takes attention away from very real emerging risks that are being faced. (Michael MacCracken, Climate Institute)	This section has been rewritten and the reference to geoengineering eliminated.
93	38923	19	8	7	8	8	Reference IPCC 2007 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
94	46988	19	8	7	8	10	The paper/framework (MOVE, 2010: Generic Conceptual Framework for Vulnerability Measurement. Seven Framework Programme, Methods for the Improvement of Vulnerability Assessment in Europe, European Commission, Brussels, Belgium.) needs to be cited here as well (as cited in the SREX), as it includes already conceptual approaches taken up in the SREX report (including link to adaptation, including different types of capacities etc.) (Stefan Kienberger, University of Salzburg)	This is now cited.
95	38924	19	8	8	8	9	Reference Blaikie et al., 1994 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
96	38925	19	8	10	8	10	Reference Tol and Yohe 2006 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
97	38926	19	8	29	8	30	Reference Blaikie et al., 1994 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
98	39882	19	8	34	8	34	don't use 'etc' it is imprecise. Give the reader all the informaiton they need (Peter Burt, University of Greenwich)	This section was revised accordingly.
99	46989	19	8	35	8	37	The paper/framework (MOVE, 2010: Generic Conceptual Framework for Vulnerability Measurement. Seven Framework Programme, Methods for the Improvement of Vulnerability Assessment in Europe, European Commission, Brussels, Belgium.) needs to be cited here as well (as cited in the SREX), as it includes already conceptual approaches taken up in the SREX report (here: the human and socio-ecological component) (Stefan Kienberger, University of Salzburg)	The paper has been included in the new version of the chapter
100	38927	19	8	36	8	36	Reference Blaikie et al., 1996 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
101	46990	19	8	39	8	39	For the cultural dimension also the MOVE framework (MOVE, 2010: Generic Conceptual Framework for Vulnerability Measurement. Seven Framework Programme, Methods for the Improvement of Vulnerability Assessment in Europe, European Commission, Brussels, Belgium.) could be cited, as it includes this dimension (MOVE framework cited in SREX report) (Stefan Kienberger, University of Salzburg)	Okay, we refer to these issues in the text
102	53770	19	8	47	8	51	The definition of climate change used by the IPCC is not the definition used by the UNFCCC; it includes anthropogenic and natural climate change. (Kristie L. Ebi, IPCC WGII TSU)	We believe we have been consistent and appropriate in our usages of the term.
103	53771	19	9	8	9	11	Current vulnerability does not include consideration of future adaptive capacity. (Kristie L. Ebi, IPCC WGII TSU)	We discuss the issue of future adaptation and vulnerability thoroughly in 19.6
104	46991	19	9	13	9	14	The paper of Kienberger, S., 2012. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0174-9 could be cited here as well, as tries to visualise different cultural or stakeholder related perceptions of vulnerability in a visual manner (Stefan Kienberger, University of Salzburg)	This is now cited.
105	46992	19	9	36	9	36	The following paper could be integrated here as well: Kienberger, S., 2012. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0174-9; AND Kienberger, S., Lang, S., Zeil, P., 2009. Spatial vulnerability units – expert-based spatial modelling of socio-economic vulnerability in the Salzach catchment, Austria, Nat. Hazards Earth Syst. Sci., 9, 767-778. http://www.nat-hazards-earth-syst-sci.net/9/767/2009/nhess-9-767-2009.html (Stefan Kienberger, University of Salzburg)	We considered the paper Kienberger 2012 which is somewhat similar to the paper here
106	46993	19	9	45	9	47	The following papers could be integrated here as well: Hutton, C. W., Kienberger, S., Amoako Johnson, F., Allan, A., Giannini, V., Allen, R., 2011. Vulnerability to climate change: people, place and exposure to hazard, Adv. Sci. Res., 7, 37-45, doi:10.5194/asr-7-37-2011. http://www.adv-sci-res.net/7/11/2011/asr-7-37-2011.html (Stefan Kienberger, University of Salzburg)	Paper has been included in the new version of the chapter
107	48933	19	9	48	10	8	is the 'timing of impacts' - eg the difference in vulnerability due to (say) longer time horizon issues such as sea level rise as distinct from more immediate vulnerability due to (say) higher intensity rainfall / flooding in urban areas - intended to be picked up in the term 'temporal dimensions' (p10, line 8) - if so, suggest that it is worth expanding to clarify (Leon Soste, Department of Primary Industries, Victoria, Australia)	Correct, and we believe the dicussion here is adequate. The issue is again discussed in a later section
108	39883	19	10	2	10	2	replace 'like' with 'such as' (Peter Burt, University of Greenwich)	We felt that the original wording was clear and grammatically correct.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
109	46994	19	10	23	10	24	The paper Kienberger, S., 2012. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0174-9 could be taken as reference as it presents a "relative" and spatial vulnerability assessement (Stefan Kienberger, University of Salzburg)	Paper has been included in the new version of the chapter
110	38928	19	10	40	10	40	Reference IPCC 2007, AR4 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
111	41201	19	11	1	11	2	Section 19.2.2.1 pg11 line 1-2 – need to add “e.g.” to this list of social-ecological systems as it is not a definitive list. (Susan Evans, WWF-Canada)	We took this suggestion into consideration - the paragraph has also been modified
112	49161	19	11	3	11	3	The term "Tipping point" is used here, and several other places in the chapter. Please make sure that this term is included in the AR5 glossary, and that it is used consistently with this definition through chapter 19. (Oyvind Christophersen, Climate and Pollution Agency)	This has been done
113	53772	19	11	19	0	0	This section could explicitly mention teleconnections. (Kristie L. Ebi, IPCC WGII TSU)	Okay, this was considered in the part on critical infrastructures.
114	39884	19	11	22	11	23	don't use 'etc' it is imprecise. Give the reader all the information they need (Peter Burt, University of Greenwich)	"Etc." was removed.
115	54332	19	11	23	11	25	A brief elaboration here would be useful. What if, for instance a potential impact had a high probability but low magnitude. Could such a risk possibly be considered key? (Michael Mastrandrea, IPCC WGII TSU)	The key point we want to make is that extreme events or high hazards only become a key risk if also the vulnerability of the system exopsed is high and vice versa if the hazard has a low probability and low magnitued and the vulnerability is high - it is still a low risk. For hazards that have a low probability but in case they a coccur a high magnitude - we would have to examine the vulnerability to these phenomena in orderr to judge wether the risk is high or low.
116	51075	19	11	27	11	28	It would be helpful to clarify that the criteria here presumably also consider impacts for societal and social-ecological systems, as well as the additional consideration of physical impacts. (Katharine Mach, IPCC WGII TSU)	We try to be more coherent in differentiating physical impacts, hazards, and consequences.
117	51076	19	11	30	11	30	The author team might consider if a phrase such as "if associated consequences have large magnitude..." in place of "if judged" would apply more broadly across differing conceptions of the definition of risk. (Katharine Mach, IPCC WGII TSU)	The wording would also be OK, however, the old wording is still appropriate, since the associated consequences have a large magnitude would lead to the question - what are the associated concequences. Perhaps this aspect can once more be discussed and if needed or useful be changed in the next iteration phase.
118	52216	19	11	30	11	30	Presumably, this should say "Risks." (Michael MacCracken, Climate Institute)	I am not fully sure whether I saw the word - but now it says risk
119	52217	19	11	30	11	53	Using these criteria, which make good sense, it is really very hard to understand the focus on geo-engineering/SRM as an emergent risk at this point. First, the likelihood of the example that is described, namely global SRM, is not very likely; second, the application of SRM is reversible as opposed to adding CO2 to the atmosphere, thawing the permafrost, and more; and third, the magnitude and character of the SRM application can be changed--Robock et al.'s proposed application is not at all the only possible application (see, for example, MacCracken, M. C., Shin, H-J., K. Caldeira, and G. Ban-Weiss, 2012: Climate response to solar insolation reductions in high latitudes, Earth System Dynamics, submitted prior to July 31, 2012 and published as a discussion paper at http://www.earth-syst-dynam-discuss.net/3/715/2012/esdd-3-715-2012.html). In addition, the magnitude can be adjusted over time--there are lots of possibilities. So, by these criteria, it is just hard to understand the early focus on geo-engineering/SRM in the early parts of this chapter. (Michael MacCracken, Climate Institute)	We have reduced the focus on geoengineering.
120	53773	19	11	49	11	53	And these risks change over time. (Kristie L. Ebi, IPCC WGII TSU)	Yes risks are changing over time due to changes in vulnerability and hazard profiles, however, I am not fully sure whether this has to be stressed here. It has been stressed in various other parts of the chapter - e.g. In the first section and the discussion on trends which proof that risks determinants are changing over time.
121	46995	19	12	24	0	0	The section "19.2.4. Identifying Key and Emergent Risks under Alternative Development Pathways" should include at the very beginning a definition what is understood as "development pathway" or provide a reference within the report where this can be found. It would get clearer if a short discussion on this would be included. (Stefan Kienberger, University of Salzburg)	Text has been added to define this term based on the Hallegatte et al. (2011) reference cited at this point in the text.
122	47897	19	12	24	12	50	The following new paper may be of use for an example of identifying risk under various pathways for forested systems: Iverson L., Matthews S., Prasad A., Peters M. and Yohe G. 2012. Development of risk matrices for evaluating climatic change responses of forested habitats. Climatic Change 114: 231-243. (Louis Iverson, US Forest Service)	We have looked at the reference and while interesting did not seem a good fit for the broad, conceptual approach in this section.
123	43365	19	12	48	0	0	The reference "Fuessel 2009" is not included in the references list. (Hans-Martin Füssel, European Environment Agency)	This reference has been included.
124	52145	19	13	0	0	0	"Section 19.3.2.1 In a very recent study (Norberg et al., 2012) clearly indicated that it is not enough to know that climate change alters global species diversity, the distribution of human pathogens and ecosystem services. Predictive models do forecast these changes but it is rare that evolutionary responses are given due consideration. According to Norberg et al., (2012) dominated during the later stages of climate changes and in hot regions. Moreover, they have noted the remarkable impact of climate change on species extinction and evolutionary debts, with changes in species richness and traits occurring long after climate stabilization. It has been justly concluded by the authors that even if we halt anthropogenic climate change today, transient eco-evolutionary dynamics would ensure centuries of additional alterations in global diversity . (Ref : Jon Norberg, Mark C Urban, Mark Vellend, Christopher A Klausmeier and Nicolas Loeuille. 2012 Eco-evolutionary responses of biodiversity to climate change. Nature Climate Change doi: 10.1038/nclimate 1588)" (Shelley Bhattacharya, Visva Bharati University)	This is beyond the scope of this chapter.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
125	39885	19	13	26	13	26	change 'are' to 'is' (Peter Burt, University of Greenwich)	The wording was changed accordingly.
126	53774	19	13	32	13	46	This is another place where teleconnections could be mentioned. (Kristie L. Ebi, IPCC WGII TSU)	Thank you. We have integrated teleconnections into the sectionthat discusses the criteria for identifying key risks (19.2.2.2).
127	38477	19	13	34	13	36	This situation is changing quite rapidly - and certainly has done since the 2008 cited reference. Impacts studies which use daily data input are implicitly considering, in part, changes in weather extremes. (Claire Goodess, University of East Anglia)	Most impact studies reviewed in AR4.
128	48934	19	13	34	13	36	in Australia - we tend to have sequences of different types of extremes - typically drought followed by flood - the progressive weakening of the primary producer community by drought results in those actors being contextually more vulnerable to flood. Links also to post disaster and recovery phases (p31, line 13) (Leon Soste, Department of Primary Industries, Victoria, Australia)	Thank you. Yes, this is so.
129	39886	19	13	46	13	46	move . To other side of 2nd) (Peter Burt, University of Greenwich)	This issue was not present in the page/line cited.
130	51077	19	13	51	0	0	Section 19.3.2.1. The author team should consider cross-referencing chapter 4 in this section. On line 54 of this page, additionally, does the author team intend a reference to chapter 4? (Katharine Mach, IPCC WGII TSU)	Thank you. We agree and have inserted cross-references to Chapter 4.
131	39887	19	13	54	13	54	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	This indicated that a reference was needed - all of these have been dealt with.
132	39888	19	13	54	13	54	this is important: please quantify 'large proportion' (Peter Burt, University of Greenwich)	This section has been rewritten and the phrase deleted.
133	38929	19	14	9	14	9	Reference Chivian & Bernstein, 2008 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
134	53775	19	14	10	14	11	How and why? (Kristie L. Ebi, IPCC WGII TSU)	We don't agree that elaboration is needed here.
135	38930	19	14	16	14	16	Reference Petzoldt et al., 2006 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
136	39889	19	14	18	14	18	reference incomplete (Peter Burt, University of Greenwich)	The in-text citations here were completed.
137	38931	19	14	20	14	21	Reference Clements & Ditommaso, 2011 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
138	38932	19	14	21	14	21	Reference Bradley et al 2009a is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	Bradley et al. 2010a has been added (Bradley et al., 2009a was incorrect)
139	44817	19	14	28	0	0	Suggest adding a transition paragraph that discusses some impacts of ecosystem service loss that are not expressed in economic terms (possibly referring to later sections of the chapter). Moving too quickly to economic estimates can cause two problems: first, it gives the impression that the sums of money listed could "buy back" lost or degraded ecosystem services (but for example, if pollinators collapsed in the UK, it would cause more fundamental problems than needing 430 million GBP). Second, because the estimates are spread over such large ranges (e.g. 1-100 billion USD for recreational use of forests in the US) the impact on the reader is weakened. Statements along the lines of page 34, lines 41-43 about the number of people depending on particular ecosystem services in particular ways could be useful here. (Carol Hunsberger, Institute of Social Studies)	We will take this suggestion under consdieration for FGD as we consider our space constraints.
140	39157	19	14	29	14	30	The severe consequences of a loss of pollinating insects is not adequately reflected in the report, and perhaps something could be added here. This loss is already occurring, though CC may not be the main driver yet. Note that this means not just domestic bees but countless wild bee and other pollinator species. These do not just pollinate domestic crop plants but also a vast range of wild plants, which in turn support a host of animal species. The ecosystem effect of polinator loss is thus immense. I would like to see some research on how temperature rises will impact on this. (Thomas Reuter, University of Melbourne)	This asks for a level of detail not consistent with out space limtiations, but it has been clarified that the NEA UK work refers to wild plant as well as crop pollination, and a phrase added to acknowledge the point, cross referencing Ch 4.
141	51078	19	14	31	14	31	It would be preferable to indicate the timeframe for this increase. (Katharine Mach, IPCC WGII TSU)	This occurred over the past 60 years and has been clarified.
142	51079	19	14	36	14	36	It would be clearest to specify that these monetary values are in USD (presumably). (Katharine Mach, IPCC WGII TSU)	This is correct and the text has been clarified
143	44818	19	14	44	14	51	Platte River example: a bit more explanation would help here. What is meant by 'the total amount "paid"' (line 47) - is it estimated costs from lost ecosystem services under current practices? How does $20 per household add up in comparison to these costs and the estimated costs of improving degraded ecosystem services? (Carol Hunsberger, Institute of Social Studies)	The text has been clarified
144	39890	19	14	46	14	47	what are the five ecosystem services (Peter Burt, University of Greenwich)	These are now listed in the text
145	51080	19	14	47	14	47	The author team might consider clarifying what is meant by "the total amount paid." (Katharine Mach, IPCC WGII TSU)	The text has been clarified
146	53776	19	14	50	14	50	Unclear what exactly is meant by values. (Kristie L. Ebi, IPCC WGII TSU)	The text has been clarified
147	44819	19	14	50	14	51	The final point in this paragraph (that restored ecosystems have lower value than intact systems) is important and I think could be made earlier in the discussion of economic estimates. (Carol Hunsberger, Institute of Social Studies)	The text has been clarified
148	44820	19	14	53	15	3	Remind the reader in a few words how climate change leads to habitat fragmentation (Carol Hunsberger, Institute of Social Studies)	We have clarified the text : we did not imply that climate change would lead to habitat fragmentation
149	44821	19	14	53	15	8	The biodiversity and GHG effects of land use change should be split into two paragraphs or a transition sentence added (Carol Hunsberger, Institute of Social Studies)	The issues are now discussed in separate paragraphs.
150	37039	19	15	3	15	8	Please take indirect effects into consideration and do not stop your analysis at the system boundaries as defined e. g. by GHG R&M guidelines. The results of Luyssaert et al. show that old-growth forests can be sinks, but comparison e. g. with managed forests show that these can be much more effective in overall GHG emission reduction if wood use is accounted for. The analysis from Anderson-Treixeira & DeLucia is thus also incomplete as it stops short at the ecosystem boundaries and does not include material use and thus results in biased recommendations. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	We will take this issue under consideration as we develop the FGD it require a level of detail for which we may not have room given our limited space.
151	39891	19	15	5	15	5	reference incomplete and not in reference list (Peter Burt, University of Greenwich)	This was corrected.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
152	49162	19	15	5	15	5	The Lussayert reference, documenting that old forests continue to accumulate carbon is missing here and in the reference list. (Oyvind Christophersen, Climate and Pollution Agency)	This was corrected.
153	54333	19	15	8	15	8	As opposed to the potential for storage of carbon in the future? It would be useful to specify further the alternative here. (Michael Mastrandrea, IPCC WGII TSU)	The text has been clarified
154	52787	19	15	11	0	0	19.3.2.2.1. A further useful reference on these interactions is: Pittock, J. (2011). National climate change policies and sustainable water management: conflicts and synergies. Ecology and Society 16(2): 25. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	This reference is now cited
155	38478	19	15	23	15	29	Could also include desalination as an example here. (Claire Goodess, University of East Anglia)	A sentence has been added to include desalinisation
156	44822	19	15	23	15	29	I think it's worth mentioning water use by the energy sector here, even if only to cross-reference another part of the report (Carol Hunsberger, Institute of Social Studies)	A sentence has been added
157	37706	19	15	29	0	0	Comment 1: I think this discussion needs some concrete examples and quantitative analyses of the energy water nexus. Add(?): Kelic (Kelic et al., 2009) studied the strategies for the energy sectors to accommodate drought conditions. Other studies have addressed the energy, water, land nexus that drought conditions present to the agricultural and energy sectors (Skaggs et al., 2012, Tidwell et al., 2011). Roy (Roy et al., 2012) provides estimates on how climate change will affect the and demand supply of water for various uses in the United Sates down to the county level. The study shows that many regions could experience of water stress. . [Kelic, A., V. Loose, V. Vargas, and E. Vugrin, 2009: Energy and Water Sector Policy Strategies for Drought Mitigation. Report SAND 2009-1360, Sandia National Laboratories Albuquerque, NM. Available at: http://prod.sandia.gov/techlib/access-control.cgi/2009/091360.pdf DOI 10.2172/974886] (George Backus, Sandia National Laboratories)	We shall consider this useful suggestion for inclusion in the FGD. At this time, it is not clear that we can afford the space for all the additional text suggested here. However, we have added a new sentence and some of these citations.
158	37707	19	15	29	0	0	Comment 2: [Skaggs, R., T.C. Janetos, K.A. Hibbard, and J.S. Rice, 2012: Climate and Energy-Water-Land System Interactions: Technical Report to the U.S. Department of Energy in Support of the National Climate Assessment, Report PNNL-21185, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-21185.pdf] [Tidwell, V.C., P. H. Kobos, L.A. Malczynski, G. Klise, C. R. Castillo, 2011: Exploring the Water-Thermoelectric Power Nexus. Journal of Water Resources Planning and Management, Posted online on 21 Dec 2011. doi: 10.1061/(ASCE)WR.1943-5452.0000222] [Roy, S.B., L.Chen, E.H. Girvetz, E.P. Maurer, W.B. Mills, and T.M. Grieb, 2012 Projecting Water Withdrawal and Supply for Future Decades in the U.S. under Climate Change Scenarios, Environmental Science & Technology, 46 (5), 2545-2556 DOI: 10.1021/es2030774] (George Backus, Sandia National Laboratories)	Please see response to previous comment.
159	49163	19	15	30	15	44	We think that the discussion of increased ground water extraction and water availability merits a place in the executive summary. (Oyvind Christophersen, Climate and Pollution Agency)	We agree - this information has been added to the ES.
160	44823	19	15	32	0	0	Move sentence beginning with "The second issue..." away from the one before it starting with "However, there are opportunities..." since groundwater extraction is presented as a problem, not an opportunity (Carol Hunsberger, Institute of Social Studies)	The sentences are in different paragraphs.
161	43081	19	15	47	0	0	Why only biofuels and not bioenergy in generell? (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	The text has been revised to incorporate this limitation.
162	49164	19	15	47	0	0	Section 19.3.2.2.2. including table 19.1 on page 79. Comment. The section deals with the effects of development of biofuels and diets on land use, natural forests and carbon stocks with a number of figures which are difficult to compare. To improve the understanding it could be useful to compile comparable figures for global land use, area for pastures, crop land and biofuels both today and under a few scenarios for development of biofuel demand and meat consumption. This is elaborated more detailed in the comments below (Oyvind Christophersen, Climate and Pollution Agency)	The text has been rearranged significantly and new discussion has been added to address this point. So as to avoid duplicate discussion of biofuel interactions between the original sections 19.3.2.2.2. and 19.4.3.3., all mention of how markets might respond to demand changes from biofuels and how iLUC might be avoided or reduced (they share similar strategies) has been moved to 19.4.1. In that section the potential from diets responding to demand changes have been contextualized using your calculations (~70% of ag and pasture land) and supported with other studies.
163	44824	19	15	49	15	50	Biofuel production can also displace grazing land / pastoralism which is not reflected in the binary "land for food cropping or natural, unmanaged ecosystems" (Carol Hunsberger, Institute of Social Studies)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. All discussion of iLUC mitigation strategies have been moved to what is now 19.4.1. The text in question, although now in a new section, has been revised to address this point.
164	51081	19	15	52	15	52	If appropriate, it would be preferable to cite the specific relevant chapter of this report. (Katharine Mach, IPCC WGII TSU)	The reference has been updated to include the appropriate chapter (2).
165	39892	19	15	53	15	53	what is a second generation biofuel? (Peter Burt, University of Greenwich)	The text has been clarified to give a quick definition of second generation biofuels. Please refer to section 19.3.2.2. of the newly reorganized and rewritten section.
166	49165	19	16	3	16	7	We suggest to add, the following sentence after Mellilo et al 2009a,b) " This could bring so much terrestrial carbon, converted into CO2, in the atmosphere that it could offset partly or entirely the effect of substituting fossil - with biocarbon and obstruct the original goal of limiting atmospheric CO2. (Oyvind Christophersen, Climate and Pollution Agency)	The text has been updated with your suggested clarifying sentence.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
167	53777	19	16	3	16	7	Results also are available from the RCP special issue in Climatic Change. (Kristie L. Ebi, IPCC WGII TSU)	We were unable to determine which individual article the reviewer was referring to.
168	54334	19	16	3	16	11	Is the timeframe considered in these scenarios the 21st century? It would be useful to clarify. (Michael Mastrandrea, IPCC WGII TSU)	The text has been revised to make this clarification. The original reference did not explicitly state when the natural forest loss would be completed by, but the time frame of the article was the 21st century so the inference was made.
169	39893	19	16	5	16	5	space required between numbers and units (x2) (Peter Burt, University of Greenwich)	The text has been revised with the suggested edit.
170	49166	19	16	7	16	0	The sentence "If instead the tax is applied also to include terrestrial carbon, the area of forested land increases" seems a bit too conclusive. Such a tax could however reduce the deforesteration compared with a carbon tax only on fossil C. How much will depend on the level of the carbon tax compared with the strength of other drivers. We suggest the following sentence "If instead the tax is applied also on terrestrial carbon, the deforestation could slow down or even reverse, depending on the level of the tax". (Oyvind Christophersen, Climate and Pollution Agency)	The text has been updated with your suggested sentence replacing the original.
171	49167	19	16	7	16	11	These lines contain a very important message about a measure of global size and vast effects on adaptation and mitigation. To understand this it is necessary to realize the size of the figures. 2700 Mha pasture means 27 million km2, about the entire global area of pasture, and 100 Mha of cropland, 1 million km2, about 6 % of the global area of cropland (ca 15 million km2). If this is perceived correct the suggested transition to a vegetarian diet implies a stop in livestock globally. Such a radical measure may be less realistic, but these figures show the potential in smaller changes in diett or the potential consequences of the ongoing increase in demand for meat for global land use. It means also that about 28 million km2 or 70 % of the global agriculture area is used for the production of meet and dairy products. I would suggest that the importance of the paragraph is communicated more clearly, that it is brought into the executive Summary and as well taken in consideration in chapter 7 about food production systems and food security and chapter 20 about Climate resilient pathways. (Oyvind Christophersen, Climate and Pollution Agency)	This has been addressed through major restructuring of the original sections 19.3.2.2.2. and 19.4.3.3. Please see response to comment ID 49164 for a full description of the changes.
172	51082	19	16	8	16	8	It would be helpful to clarify if the transition referred to here corresponds to a transition for everyone in the world. (Katharine Mach, IPCC WGII TSU)	Yes, this was intended to represent a global change in diet and the text (now in a new section) has been modified to reflect this point. The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions inthe original sections 19.3.2.2.2. and 19.4.3.3. Diet discussions have moved to 19.4.1 as the strategies for minimizing iLUC impacts are similar to market reponses from demand changes due to biofuels.
173	43082	19	16	13	16	17	Include also other bioenergy production as mitigation strategy. There is a generell risk, that bioenergy production does not contribute to a net mitigation because of uncertainties with the involved processes. Uncertainties due to N2O Emissions associated with bioenergy cropping have been identified as the main source of uncertainty determining the net greenhouse gas mitigation of bioenergy use. This has been analyzed thoroughly for biogas by Meyer-Aurich et al. 2012. Check if it is worth citing the study here ore include it in Table 1. Meyer-Aurich, A., Schattauer, A., Hellebrand, H.J., Klauss, H., Plöchl, M., Berg, W. (2012): Impact of uncertainties on greenhouse gas mitigation potential of biogas production from agricultural resources. Renewable Energy 37, 277-284. (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. A discussion of bioenergy (as opposed to just liquid biofuels) has been added to both sections. However, the text relevant to this comment is now in section 19.4.1 and the suggested N20 reference was added.
174	49168	19	16	19	16	19	In line 7-11 p.16 2 strategies to reduce iLUC are already mentioned. Suggest therefor to change the sentence to "in addition to the 2 strategies mentioned in the paragraph above(arbon tax also on terrestrial carbon and transition to a vegetarian diet) there exist other strategies that can reduce some of the above interaction problems, in particular iLUC (Oyvind Christophersen, Climate and Pollution Agency)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. The text in question (iLUC mitigation) has been moved to 19.4.1 and rewritten, hopefully addressing the original lack of clarity.
175	53778	19	16	19	16	19	Please define iLUC. (Kristie L. Ebi, IPCC WGII TSU)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. Both sections now define iLUC. Please refer to sections 19.3.2.2 and 19.4.1.
176	49169	19	16	22	19	23	The sentence "These include ensuring that increases in land use due to biofuel production is accompanied by concomitant improvements in agricultural management, such as intensification" is unclear; does it mean that the land needed for biofuel is taken from land for food production, but that the food production is kept on the same level by higher production per ha through better management/intensification, not through new cultivation of e.g forest? (Oyvind Christophersen, Climate and Pollution Agency)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. The original line of text in question has been removed and the newly rewritten text (now in 19.4.1) hopefully addresses the criticism.
177	44825	19	16	24	16	25	The 'marginal land' argument for biofuel production needs at least two qualifications: first, 'marginal' is often equated with 'unused' or 'low-value' in terms of crop production, but this overlooks other land uses such as pastoralism which may be displaced; second, first-generation biofuel crops in many cases need significant inputs of water and/or nutrients to achieve decent yields in these areas. (Carol Hunsberger, Institute of Social Studies)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. The original line of text in question has been completely rewritten to reflect your suggestions and is now part of a larger discussion on mitigating iLUC in 19.4.1.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
178	44826	19	16	26	16	27	Spell out more clearly how fertiliser management helps avoid iLUC (by "rate of improvement" do you mean "rate of intensification"?) (Carol Hunsberger, Institute of Social Studies)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. The original line of text in question has been removed.
179	51083	19	16	30	0	0	Section 19.3.2.3. The author team should consider cross-referencing Chapter 11 in this section. (Katharine Mach, IPCC WGII TSU)	We appreciate and agree with this comment, and will be including such cross-references in this section in the FGD.
180	44827	19	16	35	0	0	Consider changing to "the impact of climate change will differ WITHIN AND BETWEEN regions..." (Carol Hunsberger, Institute of Social Studies)	This has been changed.
181	53779	19	16	36	16	36	Sanitation is also incredibly important. (Kristie L. Ebi, IPCC WGII TSU)	changed - How was this changed/addressed? I added in sanitation to the sentence "These effects will differ substantially depending on current epidemiologic profiles, reflecting the level of development and access to clean and plentiful water, food and access to adequate sanitation and health care resources.
182	51084	19	16	40	16	43	The author team could consider specifying the relevant climate/socio-economic scenario here. (Katharine Mach, IPCC WGII TSU)	A2 emission scenario added
183	53780	19	16	42	16	42	Please explain stunting and its consequences. (Kristie L. Ebi, IPCC WGII TSU)	Done
184	51085	19	16	48	16	51	For these examples, the author team should consider cross-referencing relevant sections of other chapters or providing citations. (Katharine Mach, IPCC WGII TSU)	We appreciate and agree with this comment, and will be including such cross-references in this section in the FGD.
185	53781	19	17	2	17	6	Please differentiate between developed and developing countries. (Kristie L. Ebi, IPCC WGII TSU)	This differentiates urban/non-urban, the developed/underdeveloped distinction is not really relevant here, these risks are present in urban areas of underdeveloped countries as well
186	53782	19	17	6	17	6	Please add some discussion of worker/occupational health and heat issues. (Kristie L. Ebi, IPCC WGII TSU)	Due to space limitations and the paucity of studies linking occupational heat exposures and climate change, this disucssion was omitted in this chapter. Chapter 9 does address occupational health issues and climate change in some detail.
187	51086	19	17	6	17	8	The author team should check this statement against the findings of the special report and the working group 1 contribution and ensure consistency. (Katharine Mach, IPCC WGII TSU)	This appears to be consistent with the findings of SREX
188	53783	19	17	15	17	15	Please provide references supporting attribution to climate change. (Kristie L. Ebi, IPCC WGII TSU)	This should cross reference WG1 findings on increased frequency, magnitude and duration of heat waves.
189	39894	19	17	21	17	21	reference not in reference list (Peter Burt, University of Greenwich)	Shao Lin has been changed to Lin 2009
190	53784	19	17	26	17	26	Not just bacteria, but a range of other pathogens. (Kristie L. Ebi, IPCC WGII TSU)	This was changed, and other pathogens were added.
191	39895	19	17	29	17	29	hanta virus here and hantavirus elsewhere (and Hantavirus/Hanta virus elsewhere in other WGII chapters) (Peter Burt, University of Greenwich)	Thank you. This has been changed.
192	46998	19	17	33	0	0	The section "19.3.2.4. Spatial Convergence of Multiple Impacts: Hotspots" attempts to provide an overlook of hot spots modelled in a spatial manner. Besides the identification of such hot spots, it is proposed to provide an overview of methodological issues in regard to the identification of hot spots. Some statements such as on page 17, line 46-47 are oversimplified and do not reflect the current state-of-the-art. It would be interesting if (even shortly) methodological issues (achievements, challenges) could be covered here as well. (Stefan Kienberger, University of Salzburg)	See the answers to the comments 195 and 196.
193	38479	19	17	35	0	0	Is this definition consistent with definitions used elsewhere in AR5? Perhaps it would be useful to include this term in the Glossary. (Claire Goodess, University of East Anglia)	Definition (and equivocality) of this term is discussed in Chapter 21. There is a need to be harmonized with the chapter.
194	39896	19	17	35	17	35	change 'affects' to 'affect' (Peter Burt, University of Greenwich)	This has been corrected.
195	46996	19	17	46	17	47	I do not agree that (spatial) vulnerability assessments are carried out only by 'overlaying' data. Spatial vulnerability assessment try to integrate different approaches based on statistical approaches but also innovative approaches to map spatial hot spots. It is agreed that synergistic influences may be difficult to quantify, however changes in dynamics could be approached. This statement should be further expanded and should reflect current advancements in the modelling of vulnerability. Examples for spatial vulnerability assessement can be cited as follows: Kienberger, S., 2012. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0174-9; AND Kienberger, S., Lang, S., Zeil, P., 2009. Spatial vulnerability units – expert-based spatial modelling of socio-economic vulnerability in the Salzach catchment, Austria, Nat. Hazards Earth Syst. Sci., 9, 767-778. http://www.nat-hazards-earth-syst-sci.net/9/767/2009/nhess-9-767-2009.html (Stefan Kienberger, University of Salzburg)	Thank you for the comment. But what is argued in this comment is on spatial vulnerability assessments and not on identification of spatial multi-impacts hotspots.
196	46997	19	17	50	17	50	After the example of global assessements, also regional/sub-national hot spot assessments should be included; such as UNEP (2012) Livelihood Security: Climate Change, Migration and Conflict in the Sahel (http://www.unep.org/disastersandconflicts/Introduction/EnvironmentalCooperationforPeacebuilding/EnvironmentalDiplomacy/SahelReport/tabid/55812/Default.aspx) AND Kienberger, S., 2012. Spatial modelling of social and economic vulnerability to floods at the district level in Búzi, Mozambique. Natural Hazards (online). http://dx.doi.org/10.1007/s11069-012-0174-9 (Stefan Kienberger, University of Salzburg)	Thank you for the comment. But what is argued in this comment is on spatial vulnerability assessments and not on identification of spatial multi-impacts hotspots.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
197	52221	19	18	1	18	2	As other examples that might be included, thinking only for the US, I would suggest the SF Bay/Sacramento-San Joaquin delta and/or Chesapeake Bay. The former area is also at risk because of the danger of earthquakes and the latter because of land subsidence that carries over from the Last Glacial Maximum when this region was pushed upwards. (Michael MacCracken, Climate Institute)	Thank you for the comment. We agree that the suggested locations are at high-risk due to non-climatic hazards as well as a climate impact, however they don't suffice the criteria defined in the first paragraph of this sub-section (multi-impacts).
198	49170	19	18	4	18	21	We propose to include these examples of hotspots in the Executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Thank you for the comment. We have included examples of hotspots in the ES according to this comment.
199	38933	19	18	5	18	5	Reference Crowley et al., 2011 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
200	52218	19	18	5	18	5	I would suggest that only citing the Inuit when talking generally about the Arctic is inappropriate. There are something like 7 indigenous groups in high latitudes (that are all parties to the Arctic Council), and all face quite serious impacts so that this example should be generalized. (Michael MacCracken, Climate Institute)	Thank you for this comment. We have addressed this issue and refer more broadly to indigenous groups.
201	51087	19	18	5	18	21	For these examples, the author team should also consider and cross-reference relevant sections from other chapters of the report (28 for example 1, 6 and 30 for example 2, 24 for example 3, 22 for example 4). (Katharine Mach, IPCC WGII TSU)	Thank you. We have revised this paragraph and included a cross-reference to Chapter 28.
202	52219	19	18	7	18	7	I would just suggest that care needs to be used when saying "extinction." My understanding is that extinction is only the appropriate word when all members of an organism on Earth die, so including those in zoos, reserves, etc. The appropriate word for use when all in the wild are wiped out is extirpation--a rather unfamiliar and perhaps unfortunate word as few people know what it means, but it is important to be scientifically accurate, and extinction is not necessarily right. (Michael MacCracken, Climate Institute)	Although the reviewer is correct, the term ‘extinction’ has been widely used in this context in the literature.
203	52220	19	18	9	18	9	It is not just Alaskan ecosystems at risk. There are ecosystems all around the Arctic that are at risk, and this statement should be generalized. (Michael MacCracken, Climate Institute)	Generalised statement as requested.
204	39897	19	18	12	18	12	space required between numbers and units (Peter Burt, University of Greenwich)	This has been corrected.
205	39898	19	18	16	18	16	don't use 'etc' it is imprecise. Give the reader all the information they need (Peter Burt, University of Greenwich)	"Etc." was removed.
206	38934	19	18	18	18	18	Reference AR4 WGII is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference was deleted. (The statement can be supported just by Ericson et al (2006).)
207	38480	19	18	23	18	29	While PESETA is certainly an important study, I'm not sure how relevant it is to the identification of hotspots - largely because of the spatial scale/aggregation and didn't consider all interactions/feedbacks. Though arguably, it does provide supporting evidence of Southern Europe as a European hotspot. (Claire Goodess, University of East Anglia)	According to the definition taken in this sub-section, even without considering feedbacks, a location/region can be classified as a hotspot. We think PESETA's finding is also relevant in this.
208	44828	19	18	30	0	0	What can be done to improve hotspot analysis? You identify limitations but could go further with constructive advice (Carol Hunsberger, Institute of Social Studies)	This is a sentence to mention the limitation for better communication of the assessment in this sub-section. Thus, we think constructive advice is not necessary here.
209	49171	19	18	32	19	10	References are peculiar in this section (Oyvind Christophersen, Climate and Pollution Agency)	This section has largely been deleted.
210	52097	19	18	34	18	40	This definitional discussion of the term "maladaptation" would ideally also refer to the entry for the term in the report glossary. (Katharine Mach, IPCC WGII TSU)	From AR4 and SREX - Glossary
211	38935	19	18	36	18	36	Reference IPCC 2001 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
212	52792	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. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	We have had to shorten the goverance section because the issue is handled in another chapter, and so we did not mention this point again.
213	39899	19	18	48	18	48	reference incomplete (Peter Burt, University of Greenwich)	This was corrected.
214	39900	19	18	53	18	53	reference incomplete (Peter Burt, University of Greenwich)	This was corrected.
215	44829	19	18	53	19	1	Could add "…agricultural intensification… entrains negative impacts such as NUTRIENT LOADING AND reduced biodiversity" (soil compaction and degradation are also relevant) (Carol Hunsberger, Institute of Social Studies)	This section on maladaptation was removed from the text.
216	38896	19	19	1	19	10	Building dams, as one of the maladaptation feature can cause a number of impacts, but for Egypt the major impacts are related to impacts of land fertility since the silt sediment used to be brought by the flood is not available anymore. Fertility losses and soil erosion are the major impacts while the production of parasites in nearby lakes are of minor importance. (Mohamed Tawfic Ahmed, Suez Canal University)	This section on maladaptation was removed from the text.
217	39901	19	19	7	19	7	reference incomplete (Peter Burt, University of Greenwich)	This was corrected.
218	52793	19	19	13	0	0	19.4. Moser (2011) refers to these as tele-connections. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	We find this confusing with meteorological use of this word and prefer not to use it in a title. We do use the term slightly differently in 19.2.2.2
219	39158	19	19	15	19	33	The impact of climate change on crop yields is "exportable" through a trade system which allows one to purchase grain etc to make up for the deficit, use land leased from poor countries, ban exports or otherwise offload the impact on those most vulnerable in the world (read: least able to pay). The point is that 'competitive market forces' DO NOT RECOGNIZE THE CONCEPT OF JUSTICE. Only cooperation and sharing based on human empathy and solidarirty will prevent the loss of billions of lives to CC impacts. This must be stated in the strongest possible terms in this report. Failure to do so is tacit support for a game plan whereby "only the rich will survive" (as portrayed in the disaster film '2012'). One way to achieve this would be to regulate the world food trade in such a way that NEED comes before ABILITY TO PAY. (Thomas Reuter, University of Melbourne)	We agree and this important concept has been added to section 19.4. as well as referring the readers to sections 19.6.1.2. on differential vulnerability.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
220	51088	19	19	22	0	0	Section 19.4.1. The author team should consider and potentially cross reference sections of Chapter 7 here. (Katharine Mach, IPCC WGII TSU)	We agree and cross-references have been added to sections 7.2.2. on food security and 7.3.2.1.1. on how climate change can impact crop yields.
221	53785	19	19	22	0	0	This section could include reference to the WGI findings. (Kristie L. Ebi, IPCC WGII TSU)	We appreciate this comment and will consider cross-referencing WGI in this section in the FGD.
222	44830	19	19	25	20	23	I think the discussion on food prices should say something about differential vulnerability - the risks are currently stated only at the country level. Even if the intent is to save that discussion for later, one sentence with a cross-reference to 19.6 would be appropriate (Carol Hunsberger, Institute of Social Studies)	We agree and this important concept has been added to the parent section 19.4. as well as referring the readers to sections 19.6.1.2. on differential vulnerability.
223	39902	19	19	34	19	38	bad English! (Peter Burt, University of Greenwich)	Based on the comment this sentence has been rewritten for clarity.
224	39903	19	19	40	19	40	reference incomplete (Peter Burt, University of Greenwich)	Incomplete references were completed throughout the text.
225	49172	19	19	45	19	45	Is it not possible to use median temperature projections for AR5? (Oyvind Christophersen, Climate and Pollution Agency)	We will include median temperature projections from WGI in this section in the FGD.
226	51089	19	19	45	19	45	It would be beneficial to indicate the climate/socio-economic scenarios for which this statement holds. (Katharine Mach, IPCC WGII TSU)	This section was reorganized and reworded so that temperate and tropical impacts are more clearly delineated. Please refer to 19.4.1 paragraph 2.
227	38481	19	19	51	19	54	These two sentences seem rather contradictory - the first implies that there is a weather effect. The 75 million undernourished people seems a particularly striking conclusion (reference is not yet given) - but the rest of the paragraph implies greater uncertainty in understanding/disentangling different effects. (Claire Goodess, University of East Anglia)	This paragraph was edited to have a more prominent focus on yield impacts from extreme weather events and their possible ties to CC. The contradiction as originally written has hopefully been addressed. A reference was also added for the "75 million more undernourished" statement. Please refer to 19.4.1 paragraph 3.
228	39904	19	19	53	19	53	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	A reference was added for the "75 million more undernourished" statement.
229	51090	19	20	6	20	6	It would be helpful to specify further what is meant by "risk"--risk in the context of which extreme weather events? (Katharine Mach, IPCC WGII TSU)	The original reference was indeed referring to increased risk from future CC-related extreme weather events and the text was clarified as such. Please refer to 19.4.1. paragraph 3.
230	38482	19	20	7	0	0	Does the Jones and Sanyang study explicitly relate to extreme weather event driven changes? (Claire Goodess, University of East Anglia)	The study in question did not specifically link weather events to increased food insecurity… The passage was removed so as not to distract from the discussion. Please refer to 19.4.1. paragraph 3.
231	51091	19	20	16	20	20	For the statements, as appropriate the author team should consider specifying the relevant climate/socio-economic scenarios and time frames. Additionally, the cross reference to chapter 7 should be completed. (Katharine Mach, IPCC WGII TSU)	The study in question refers specifically to US yields and that clarification was made. Also, a cross-reference has been added to section 7.3.2.1.1. on how climate change can impact crop yields.
232	35111	19	20	35	0	0	"19.4.2.1. Human Migration and Displacement" I suggest including data from the annual reports from the Internal Displacement Monitoring Centre since they have been monitoring global (internal and external) displacement due to natural hazard-induced disasters, including climate-related disasters, over the past 4 years. Numbers for 2011 show that around 14,9 million people were displaced. Around 90 percent is due to climate-related disasters, and around 90 percent is in Asia. A few mega-disasters often displace huge amounts of people such as the floods in China in 2010. So far the numbers exclude people displaced in slow-onset disasters, such as drought, due to the challenges related to determining causality and forced displacement (rather than voluntary migration) in such cases. The reports are all available at www.internal-displacement.org For more on drought, displacement (includingt cross-border) and human security in Africa, see Kolmannskog 2010, Climate Change, Human Mobility, and Protection: Initial Evidence from Africa, Refugee Survey Quarterly (2010) 29 (3): 103-119. There is also an upcoming publication presenting and exploring some experiences of drought and cross-border displacement as well as policy responses in connection with the 2011 drought and famine in Somalia, see Kolmannskog and Ramstad, Experiences of drought and displacement: Case study of Somalis displaced to Kenya and Egypt due to the 2011 drought, in Climate Change Monitoring and Vulnerability Assessment in Africa (book commissioned by Haramaya University, Ethiopia, scheduled to be published in 2012 by the CAB International publishers). (Vikram Kolmannskog, Norwegian Refugee Council)	This section has been shortened and relies mostly on Chapter 12.4 for literature review.
233	38483	19	20	43	20	44	The text says a number of studies - but only one reference is given (not currently in reference list). Is this a review study? (Claire Goodess, University of East Anglia)	The citation is a review of dozens of studies.
234	39905	19	20	48	20	48	Only one? Please give reference (Peter Burt, University of Greenwich)	We are unclear what this comment refers to.
235	53786	19	20	48	20	48	The reference should be the Foresight migration report, not the food report. (Kristie L. Ebi, IPCC WGII TSU)	Error corrected.
236	38484	19	21	3	0	0	Can you give example(s) of these important exceptions? (Claire Goodess, University of East Anglia)	Discussion deleted.
237	53787	19	21	13	21	33	There also is the Foresight migration report. (Kristie L. Ebi, IPCC WGII TSU)	Error corrected.
238	54335	19	21	22	21	24	Is this 3.7% total or additional due to the effects of climate change? (Michael Mastrandrea, IPCC WGII TSU)	Discussion deleted.
239	39906	19	21	26	21	27	the use of ceteris paribus in this context does not make sense (Peter Burt, University of Greenwich)	Discussion deleted.
240	38485	19	21	30	21	31	It seems odd that the critical paper was published before the paper it is criticising - or is it just the general methodology used that is criticised? Neither is currently in the reference list. (Claire Goodess, University of East Anglia)	Discussion deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
241	49173	19	21	32	21	33	The relation between migration and climate change should be highlighted in the executive summary. (Oyvind Christophersen, Climate and Pollution Agency)	Agreed - this point has been added to the ES.
242	51092	19	21	36	21	36	It would be helpful to indicate further the nature of this migration--migration to where? (Katharine Mach, IPCC WGII TSU)	We now rely on Chapter 12.4 for such details.
243	51093	19	21	41	21	44	For these conclusions, the author team might consider using calibrated uncertainty language to characterize its degree of certainty in the statements. (Katharine Mach, IPCC WGII TSU)	We agree and have added uncertainty language to this statement.
244	51094	19	22	2	0	0	Section 19.4.2.2. To characterize the author team's conclusions in this section, calibrated uncertainty language may be of use, particularly for the paragraph on page 22, lines 22-33, and on page 23, lines 6-9. (Katharine Mach, IPCC WGII TSU)	Calibrated uncertainty language has been inserted.
245	54336	19	22	2	0	0	Section 19.4.2.2: It would be very useful to cross-reference and coordinate with other chapters discussing this issue, including Chapters 12, 16, and 18. (Michael Mastrandrea, IPCC WGII TSU)	Extensive effort has been made to coordinate with these other chapters.
246	39907	19	22	5	22	5	split infinitive (Peter Burt, University of Greenwich)	Fixed.
247	49174	19	22	22	22	33	We think that the emerging risk of violence assosiated with climate changes merits to be highlighted in the executive summary. (Oyvind Christophersen, Climate and Pollution Agency)	The emergent risk of conflict is now highlighted in the ES.
248	48148	19	22	32	22	32	After Theisen, 2012 add reference to: Scheffran, J., Brzoska, M., Kominek, J., Link, P.M. & Schilling, J. (2012): Climate change and violent conflict, Science, 336, pp. 869-871. (Jürgen Scheffran, University of Hamburg)	Scheffran et al. is not an original study, so it was not included in the list of studies providing original evidence. However, it has been added in the discussion of causal pathways.
249	48149	19	22	35	22	42	As of today, reference Hsiang & Burke 2012 is not accessible or not published. Since it is cited several times in this chapter, it is not possible to check the results. Some of the claims on climate change and violent conflict go beyond the statements in Chapter 12 and deserve coordination. The literature review in a Science article and book on climate change and violent conflict (Scheffran et al. 2012) would fit here. (Jürgen Scheffran, University of Hamburg)	Hsiang and Burke (2012) was specifically comissioned to help inform Chapter 12 of AR5. It is in review at Climatic Change and was submitted before the deadline for inclusion in the FOD. It has available to reviewers on NJLite since the FOD. Scheffran et al. (2012) is not a comprehensive literature review but a perspective piece, so its usage in this subsection is somewhat limited (although it has now been added).
250	54337	19	22	38	22	40	Please provide support for this statement. (Michael Mastrandrea, IPCC WGII TSU)	The statement has been replaced with a more precise statement about median results from a literature review of standardized quantitative estimates.
251	54338	19	22	40	22	42	Is such an extrapolation appropriate, given that this may be extrapolation beyond the range of historical conditions? (Michael Mastrandrea, IPCC WGII TSU)	There is now no explicit extrapolation.
252	53788	19	23	1	23	2	But why should current societies by a good proxy for the future? Also, please cite literature showing there isn't much of an association. (Kristie L. Ebi, IPCC WGII TSU)	Current societies are clearly an imperfect proxy for future societies, which is now implied by our explicit discussion of likely "socio-economic, political and technological advancements". With regard to other literature, contrary to widespread claims in the media and some review articles, there actually is not a literature that provides systemmatic quantitative evidence that this is no association. Some studies attempt to refute studies that present an effect, however to date these attmpted refutations actually present results that are statistically indistinguishable from the original study. Some studies have reported results that are not statistically significant, however the results from these studies are so uncertain that they are also consistent with extremely large effects, so they also do not demonstrate that there is zero association. Some studies provide estimates that are inconsistent in sign/magnitude, arguing that this indicates zero association, however this argument is logically incorrect as variable estimates imply varying statistical biases in a set of statistical models that are not well specified. Thus, while several studies claim that there is exactly zero effect, there is not actually evidence in the literature to support this claim.
253	53789	19	23	9	23	9	The evidence is not consistent; please provide a broader range of references. (Kristie L. Ebi, IPCC WGII TSU)	The claims made in the literature are not consistent, but our critical and systematic analysis of the literature reveals that not all claims in the literature are supported with evidence (see reply to comment 252). When we omit studies that do not provide evidence to support their claims, both the claims in the literature and the evidence supporting those claims are quite consistent. However, to address this concern, we do provide references to studies that are skeptical of a causal relationship in the absence of a definative mechanism.
254	39908	19	23	16	23	16	change 'ecosystem' to 'ecosystems' (Peter Burt, University of Greenwich)	Done.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
255	39909	19	23	18	23	18	taxonomic details (genus/species) required (Peter Burt, University of Greenwich)	Done.
256	51095	19	23	21	23	23	The author team might consider and cross-reference chapter 6 for this statement. (Katharine Mach, IPCC WGII TSU)	Held over for next revision to make sure that the material remains in Chapter 6, if it does then cross-referencing is a good idea
257	54339	19	23	34	23	35	Is this evidence for certain regions or certain species groups that can be specified here? (Michael Mastrandrea, IPCC WGII TSU)	The references do include meta-analyses covering a broad taxonomic range and geographic area so can be left as written.
258	39910	19	23	44	23	44	reference required (Peter Burt, University of Greenwich)	It is unclear to which parts of the line the reviewers are commenting on. If the latter then it is referenced several lines down. The former, in reference to potential needs for changes in regulations has been slightly modified and UNEP/CMS (2006) was added to the citations.
259	53790	19	23	44	23	44	References are needed. (Kristie L. Ebi, IPCC WGII TSU)	It is unclear to which parts of the line the reviewers are commenting on. If the latter then it is referenced several lines down. The former, in reference to potential needs for changes in regulations has been slightly modified and UNEP/CMS (2006) was added to the citations.
260	51096	19	24	9	0	0	Section 19.4.3.1. For this section, the author team might consider and reduce overlap with 19.3.2.2.2. (Katharine Mach, IPCC WGII TSU)	19.3.2.2.2 was removed and its content was reorganized throughout the chapter to reduce overlap with other sections.
261	53791	19	24	11	24	11	Is this always true? What are the assumptions? (Kristie L. Ebi, IPCC WGII TSU)	Thank you. We have changed the wording of this sentence to reflect the point that this is not always true.
262	38936	19	24	15	24	15	Reference Van Oorschot et al 2010 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	Reference was added.
263	39911	19	24	15	24	15	reference not in reference list (Peter Burt, University of Greenwich)	Reference was added.
264	38937	19	24	18	24	18	Reference Thomson et al 2010 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	Reference was added.
265	39912	19	24	18	24	18	reference not in reference list (Peter Burt, University of Greenwich)	Reference was added.
266	49175	19	24	22	24	38	This is a bit unbalanced Suggest that you here use the results from the SRREN about hydro power. One conclusion in this report was that it was not fruitfull to distinguish between large scale and small scale. There is a number of scales and big differences between high laiing dams in mountains and dams in lower regions. (Oyvind Christophersen, Climate and Pollution Agency)	We agree that the impact of individual dams at whatever scale depends on geographic context such as elevation, slope and river discharge, but as stated in the text this can be summarised by the inundated area to hydropower output ratio (e.g. ha/MW). There has been an alarming growth in (often mega) lowland tropical forest dams where this ratio is very low, thereby eroding both forest carbon stocks and biodiversity.
267	54340	19	24	36	24	38	Please consider the wording of the statement to avoid possible interpretation as policy prescriptive. (Michael Mastrandrea, IPCC WGII TSU)	We have edited the sentence to remove the policy prescriptive implication.
268	39913	19	24	47	24	47	change 'NTFP's' to 'NTFPs' (Peter Burt, University of Greenwich)	This change was made.
269	39914	19	25	6	25	6	change 'NTFP's' to 'NTFPs' (Peter Burt, University of Greenwich)	This change was made.
270	39915	19	25	7	25	7	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	This referred to the need for a citation, which was added.
271	51097	19	25	7	25	15	For the placeholders on lines 7 and 15, the author team should supply the missing citations by the 2nd-order draft. (Katharine Mach, IPCC WGII TSU)	We provided citations
272	49176	19	25	12	25	13	We are not sure that it is right that all renewable energy resources have lower flexibility compared to fossil fuels. At least there are also benefits in addition to mitigating climate change in that renevable energy might be found close to populations not connected to any energy grids (Oyvind Christophersen, Climate and Pollution Agency)	Comment does not necessarily refer to all renewables
273	39916	19	25	15	25	15	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	This referred to the need for a citation, which was added.
274	43080	19	25	18	0	0	Why only biofuels and not bioenergy in generell? (Andreas Meyer-Aurich, Leibniz-Institute for Agricultural Engineering Potsdam-Bornim)	The text has been rearranged significantly and new discussion has been added to address this point, both in what are now sections 19.3.2.2 and 19.4.1.
275	51098	19	25	18	0	0	Section 19.4.3.3. For this section, the author team might consider and reduce overlap with 19.3.2.2.2. (Katharine Mach, IPCC WGII TSU)	The text has been rearranged significantly so as to avoid duplicate discussion of biofuel interactions in the original sections 19.3.2.2.2. and 19.4.3.3. Most of the primary market responses to increased biofuel demand are the same strategies for mitigating iLUC impacts where previously scattered between the two sections. These discussions are now combined in section 19.4.1.
276	39917	19	25	23	25	23	change 'humans' to 'human' (Peter Burt, University of Greenwich)	This whole section (the original 19.4.3.3.) has been significantly rewritten and this line of text in particular was eliminated.
277	38486	19	25	28	0	0	Perhaps say 'would be met' rather than 'will' (Claire Goodess, University of East Anglia)	This whole section (the original 19.4.3.3.) has been significantly rewritten and this line of text in particular was eliminated.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
278	44831	19	25	31	25	34	Can this calculation be verified (i.e. that the amount of maize stated is actually being converted to ethanol)? (Carol Hunsberger, Institute of Social Studies)	This whole section (the original 19.4.3.3.) has been significantly rewritten and the US maize ethanol example has been expanded with appropriate references. Please refer to section 19.4.1.
279	52794	19	25	35	0	0	Could usefully clarify which jurisdiction this renewable fuel standard applies in. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	This whole section (the original 19.4.3.3.) has been significantly rewritten and the US maize ethanol example has been expanded with appropriate references -- including clarification that it refers to the US only. Please refer to section 19.4.1.
280	53792	19	25	45	25	46	How are offsets modified by fossil fuel use? (Kristie L. Ebi, IPCC WGII TSU)	This whole section (the original 19.4.3.3.) has been significantly rewritten and this line of text in particular was eliminated.
281	49177	19	25	49	25	49	Pleace insert "is" before "adjusted" (Oyvind Christophersen, Climate and Pollution Agency)	This whole section (the original 19.4.3.3.) has been significantly rewritten and this line of text in particular was adjusted (albeit in a different) way to correct this confusion. Please refer to section 19.4.1.
282	38898	19	26	0	0	0	19.5: Other Emerging Risks: could we consider the impact of temperature rise on methane hydrate, and the effect of methane release may have on the stability and possible Tsunami.....?????. (Mohamed Tawfic Ahmed, Suez Canal University)	We have decided not to include this topic due to the relative scarcity of new literature since AR4, particularly on the links between methane hydrate release and tsunami generation.
283	44832	19	26	1	26	1	Clarify whether pastureland is expanding elsewhere to replace that taken over by biofuel expansion (Carol Hunsberger, Institute of Social Studies)	This point exists in the original article and the text was updated to reflect your concern. Please refer to section 19.4.1.
284	44833	19	26	1	26	3	Not sure it's correct to say that by using fallow land "the indirect land effects would further reduce CO2 emissions" - more likely that using fallow land would avoid indirect land use change (and associated CO2 emissions). No citation is given for this statement (Carol Hunsberger, Institute of Social Studies)	This whole section (the original 19.4.3.3.) has been significantly rewritten and this line of text in particular was adjusted (albeit in a different) way to correct this confusion. Citations were also added. Please refer to section 19.4.1.
285	52222	19	26	8	26	12	Again, focusing in the opening sentences of this important section on geoengineering seems to me totally inappropriate given the much higher likelihood, even inevitability, of the other topics being covered. In addition, the formulation here on geoengineering itself seems incomplete and unbalanced. Any application of geo-engineering (and here it should probably say SRM instead) will be done based on a quite detailed and rigorous risk analysis weighing potential benefits (so prevention and/or alleviation of very severe consequences) versus potential risks, and likely only proceed if the benefits far outweigh potential adverse consequences. Again, why to cover geo-engineering in the opening section is just not clear--and I would suggest choosing another example (methane emissions, the health effects, etc., for example). (Michael MacCracken, Climate Institute)	This opening section does not focus on geoengineering, it just mentions that it is a topic that is covered in the section. Broader comments on the topic are addressed below in the sub section on geoengineering.
286	40567	19	26	11	26	11	replace "geo-engineering" with "geoengineering" to ensure consistency and facilitate cross-referencing and text searches (David Santillo, Greenpeace Research Laboratories)	Done.
287	38487	19	26	15	0	0	Is it the role of this chapter to consider the risk/probability of a large rise happening? And what about limits to adaptation? Reading to the end of the chapter - I see that some of these issues are picked up on again. Maybe worth saying that here and/or referring to other relevant chapters. (Claire Goodess, University of East Anglia)	Connection added in text
288	52795	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. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	This has been edited accordingly.
289	39918	19	26	19	26	19	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	This referred to the need for a citation, which was added.
290	39919	19	26	29	26	29	CITE' should be 'CITES' and date required (Peter Burt, University of Greenwich)	This referred to the need for a citation, which was added.
291	51099	19	26	37	0	0	Section 19.5.2. The author team should cross-reference relevant sections of Chapter 6 and 30 within this section. (Katharine Mach, IPCC WGII TSU)	Cross-referencing to chapter 6 has been added. Cross-referencing to chapter 30 was not directly relevant.
292	43049	19	26	37	26	37	19.5.2. Risks from Ocean Acidification - All of this information is correct and is primarily a repeat of Chapter 6; however in certain cases by focussing on selective publications slightly different points are drawn out - for example, in Fig. 19.2 the interpretation of the effects of OA on calcification differs to some extent to that in Chapter 6. It would be better not to repeat this but have it located all in one Chapter. (Cliff Law, NIWA)	Cross-referencing to Ch. 6 has been added wherever we draw on it, including for our risk judgments. We have also edited to remove redundancies with Ch. 6, while recognizing that one function of Ch 19 is to synthesize key risks from other chapters.
293	52098	19	26	39	26	41	This introduction to the term "ocean acidification" could also reference the entry in the report glossary (which is a briefer definition). (Katharine Mach, IPCC WGII TSU)	We have shortened the definition and still quote directly from WG1, but also refer to the WG2 glossary which has a consistent definition.
294	39920	19	26	42	26	42	insert 'the' before 'societies' (Peter Burt, University of Greenwich)	Done.
295	39921	19	26	49	26	49	text missing (Peter Burt, University of Greenwich)	No longer relevant, the text has been deleted.
296	54341	19	27	8	27	9	Does this assignment of medium confidence apply to the statements in the next paragraph? Please specify. (Michael Mastrandrea, IPCC WGII TSU)	This text has been deleted, and the confidence statements are now specifically assigned to judgments about particular risks.
297	51100	19	27	9	27	9	"Medium confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Done, throughout the section.
298	39922	19	27	14	27	14	reference style wrong (Peter Burt, University of Greenwich)	Reference styles have been fixed.
299	51101	19	27	32	27	33	It would be preferable to indicate more specifically what is meant by "medium to high" here. (Katharine Mach, IPCC WGII TSU)	This is the terminology used in the Ch. 6 FOD, which we have adopted but have now clarified that it refers to a range that varies across organisms.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
300	41202	19	27	32	27	38	Section 19.5.2 pg 27 line 32-38 – ADDITIONAL REFERENCES: Okey, T.A, H.M. Alidina, A. Montenegro, V. Lo, S. Jessen. 2012. Climate Change Impacts and Vulnerabilities in Canada's Pacific Marine Ecosystems. CPAWS BC and WWF-Canada, Vancouver BC. DFO. 2008b. State of the Pacifi c Ocean 2007. DFO Can. Sci. Advis. Rep. 2008/028. http://www.dfo-mpo.gc.ca/csas. Feely, R.A., C.L. Sabine, J.M. Hernandez-Ayon, D. Ianson, and B. Hales. 2008. Evidence for upwelling of corrosive "acidified" water onto the continental shelf. Science 320:1490–1492. (Susan Evans, WWF-Canada)	We have decided not to incorporate these references, judging the others that we use to be more directly relevant.
301	49178	19	27	32	27	38	We propose to include this aspect in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	This is too specifc for our ES, but is included at the general level.
302	38897	19	28	0	0	0	19.5.4. Risks from Geoengineering (Solar Radiation Management): This is a controversial issues and there is a need to cover the scattered pieces of informaiton revolving on this area. Information about chemotrails are being circulated in newspapers and people are often baffeled. (Mohamed Tawfic Ahmed, Suez Canal University)	Given the lack of scientific literature on chemotrails, we do not assess it here.
303	39923	19	28	6	28	6	taxonomic details should be in italics (Peter Burt, University of Greenwich)	Done.
304	35083	19	28	28	0	0	I appreciate there is little literature on the risks of SRM. However this section is disappointing in its current version and needs a bit of an overhaul. It repeats a lot of the material covered in WGI and goes only superficially into the impacts and risks of SRM. The authors could build on the WGI report (which would save a lot of space) and concentrate on a much more thorough assessment of impacts and risks beyond the physical climate. Moreover it is not clear why the authors have decided not to assess the risks of CDR. I would urge the authors to assess the risks of CDR in a separate subsection. (Olivier Boucher, LMD/CNRS)	The section has been substantially revised to remove redundancy with the WG1 report and focus as much as possible on the risks of SRM.
305	35084	19	28	28	0	0	If this section is about SRM only then the title should be "Risks from Solar Radiation Management". In any case the rationale for not assessing the risks of CDR should be provided. (Olivier Boucher, LMD/CNRS)	We have provided a rationale for not assessing risks of CDR, and have also added SRM to the section title.
306	35101	19	28	28	0	0	The so-called "termination risk" of SRM is mentioned but not discussed at all, when in fact it is probably the largest risk associated with a large-scale deployment of SRM. WGII should build on the simulations of SRM termination which are discussed in WGI chapter 7 and assess the risks of a rapid increase in temperature. (Olivier Boucher, LMD/CNRS)	We have revised the text to discuss the termination risk of SRM and added a cross-reference to WG1 Ch 7.
307	44737	19	28	28	0	0	It's Geoengineering, and not "Geo-Engineering." It is not used with a hyphen in the literature. (Alan Robock, Rutgers University)	Done.
308	52797	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? (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	There is one IMPLICC paper and there have been no GeoMIP papers published yet. The one IMPLICC paper (Schmidt et al., 2012) is included.
309	40568	19	28	28	28	28	replace "geo-engineering" with "geoengineering" to ensure consistency and facilitate cross-referencing and text searches (David Santillo, Greenpeace Research Laboratories)	Done.
310	49179	19	28	28	28	28	We see that geoengineering is included in the glossary of AR5. The definision is different from what is used by other organisations and inclued many different activities. Please be sure how this chapter uses the term in relation to the definition and clearly point out if the term is used differently. (Oyvind Christophersen, Climate and Pollution Agency)	We have ensured that the glossary definition and the IPCC 2012 Geoengineering Meeting Report definition are consistent and we cite both.
311	46420	19	28	28	30	7	Same as previous comment. (Chris Vivian, IMAREST)	It is unclear what this comment refers to.
312	52223	19	28	28	30	7	Regarding this section on geo-engineering/SRM, first, this section is disproportionately long given the real, rather than speculative, importance of this topic. Second, the formulation of the whole section needs to be reformulated so that it describes the comparative risk analysis that would need to be done to consider it. As presented here, it is as if geo-engineering is just going to be done to do it, and this is not the case at all. The question is whether, after all the efforts on mitigation and adaptation that can be done, and then after efforts to pull back CO2 from the atmosphere, the overall impacts for society and nature (economic, environmental, etc.) would be less were SRM to be applied in an intelligent way. This would be a very difficult analysis and a very difficult situation, and it would be useful to have this issue explained and posed in the Assessment, but this is just not done here. Talking about SRM instead as an emerging risk as if all it will do is something harmful is just not a realistic framing of the issue. I would also suggest that it is important to mention that there is a much wider range of possibilities that global stratospheric SRM instantly imposed as the case study cited in the write-up does. Not only is there the potential for cloud brightening as an alternative approach, but one could also imagine increasing tropospheric aerosols (yes, one would have to weigh the health implications, etc.) and there are suggestions for going after particular impacts rather than going global in some sort of emergency response rather than a gradual application; in my view it is important to make clear that there is a much wider range of possibilities than indicated in this chapter, some of which do not even involve, for regional efforts, putting anything into the atmosphere. For papers on potential regional approaches, see: (a) MacCracken, M. C., 2009: On the possible use of geoengineering to moderate specific climate change impacts, Environmental Research Letters, 4 (October-December 2009) 045107 doi:10.1088/1748-9326/4/4/045107 [http://www.iop.org/EJ/article/1748-9326/4/4/045107/erl9_4_045107.html]; (b) MacCracken, M. C., 2011: Potential Applications of Climate Engineering Technologies to Moderation of Critical Climate Change Impacts, IUGG Expert Meeting on Geoengineering, 20-22 June 2011, Lima, Peru, pages 55-56 in Meeting Report, edited by O. Edenhofer, R. Pichs-Madruga, Y. Sokona, C. Field, V. Barros, T. F. Stocker, Q. Dahe, J. Minx, K. Mach, G.-K. Plattner, S. Schlömer, G. Hansen, and M. Mastrandrea, Intergovernmental Panel on Climate Change, Geneva, Switzerland; (c) MacCracken, M. C., Shin, H-J., K. Caldeira, and G. Ban-Weiss, 2012: Climate response to solar insolation reductions in high latitudes, Earth System Dynamics, submitted prior to July 31, 2012 and published as a discussion paper at http://www.earth-syst-dynam-discuss.net/3/715/2012/esdd-3-715-2012.html. It just seems to me that as presented here, geo-engineering is portrayed in a very limited and negative way--as an emergent risk--when the range of possibilities is much greater and quite possibly less harmful. (Michael MacCracken, Climate Institute)	The section has been shortened to avoid redundancy with WGI coverage of this topic. While both the risks and benefits of geoengineering are important, this chapter is primarily about key risks, not benefits, so we focus on an assessment of the risks. Nonetheless, we indicate the principal benefit of geoengineering in the opening paragraph as a framing statement, before moving on to risk assessment and providing the logic for doing so.

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313	35085	19	28	30	28	31	I don't think the definition provided here quite corresponds to that provided in the synthesis section of IPCC (2011). Moreover IPCC (2011) points out that there is no clear definition of geoengineering and the boundaries with mitigation and adaptation are fuzzy. (Olivier Boucher, LMD/CNRS)	We have adopted the approach of citing both the glossary definition and the IPCC 2012 Geoengineering Meeting Report definition, which are consistent.
314	52099	19	28	30	28	34	For the definition of "geoengineering" here, the author team could cross-reference the definition for the term provided in the report glossary. (Katharine Mach, IPCC WGII TSU)	We have adopted the approach of citing both the glossary definition and the IPCC 2012 Geoengineering Meeting Report definition, which are consistent.
315	39924	19	28	31	28	31	Geo-engineering is not just manipulation of the atmosphere. It can apply to any human-induced change of the Earth system. I hesitate to use Wikipedia as a reference, but see the definition section under http://en.wikipedia.org/wiki/Geoengineering. If geo-engineering is to be used in the climate context specifically here a much clearer definition, and perhaps discussion of potential confusion, is required. (Peter Burt, University of Greenwich)	We have adopted the approach of citing both the glossary definition and the IPCC 2012 Geoengineering Meeting Report definition, which are consistent.tent.
316	49180	19	28	31	28	31	The reference (IPCC, 2011) which is clearly linked to geoengineering is not listed in the reference list. Please check and update this. This is also the case for the reference on page 29 line 3. (Oyvind Christophersen, Climate and Pollution Agency)	This reference (note it is IPCC 2012, not 2011) has been added to the reference list.
317	35086	19	28	32	28	34	With existing definitions of mitigation (source reduction or sink enhancement), there is an awful lot of overlap between geoengineering (CDR) and mitigation. Unless these definitions are flattened out for AR5 (which I doubt), this sentence is technically incorrect. My advice is that if you only discuss SRM, then you're better off defining precisely SRM and leave out the discussion of geoengineering. (Olivier Boucher, LMD/CNRS)	We have adopted the approach of citing both the glossary definition and the IPCC 2012 Geoengineering Meeting Report definition, which are consistent. We limit the section to discussing SRM and have edited to refer to it specifically rather than to geoengineering more broadly.
318	35087	19	28	35	28	39	Are so many references really needed? A couple of references are probably enough. (Olivier Boucher, LMD/CNRS)	We have reduced the number of references provided here.
319	39925	19	28	35	28	39	A good review of geo-engineering from a climate change perspective is provided by: Fox, T.A. and Chapman, L. (2011). Engineering geo-engineering. Meteorological Applications, 18:1 1-8. (Peter Burt, University of Greenwich)	We have reduced the number of references provided here, so have not included this additional suggestion.
320	52225	19	28	36	28	39	For a summary of approaches prepared as part of the World Bank report on climate change and sustainability, you might also want to include a reference to: MacCracken, M. C., 2009: Beyond Mitigation: Potential Options for Counter-Balancing the Climatic and Environmental Consequences of the Rising Concentrations of Greenhouse Gases, Background Paper to the 2010 World Development Report, Policy Research Working Paper (RWP) 4938, The World Bank, Washington, DC, May 2009, 43 pp. (Michael MacCracken, Climate Institute)	We have reduced the number of references provided here, so have not included this additional suggestion.
321	52224	19	28	40	28	40	None of the suggestions to consider geo-engineering that I am aware of consider geo-engineering a "solution"--they are considered approaches that may be capable of a net moderation of impacts (so able to reduce or prevent some impacts to a greater extent than unintended, adverse consequences that might be created). And geo-engineering is only considered a possibly appropriate approach to complement significant efforts on mitigation and adaptation--it is by no means an alternate to such efforts. (Michael MacCracken, Climate Institute)	We believe the current text is consistent with this view.
322	35088	19	28	40	28	41	I think the authors mean "…that nations MIGHT consider geoengineering solution…". It is not clear to me that the two references at the end are the best ones to make this point. (Olivier Boucher, LMD/CNRS)	This text has been deleted.
323	38488	19	28	46	0	0	Perhaps say why only SRM is considered here. (Claire Goodess, University of East Anglia)	We have now indicated why we assess risks only from SRM.
324	35089	19	28	46	28	46	If you mean SRM, then say SRM. There is no need to use one term for the other. That can only confuse the reader. (Olivier Boucher, LMD/CNRS)	We have edited the text to refer directly to SRM.
325	52226	19	28	47	28	48	The use of the word "schemes" seems pejorative--a better word choice would be "approaches". As noted in another comment, stratospheric aerosols and cloud brightening, while two leading approaches, could be applied in a much wider range of ways than indicated here (or in the papers describing them), and there are other possible approaches for potential application other than limiting global climate change. In any case, not presenting the whole issue as a comparative risk analysis and using available approaches as they might best be used to address a range of possible objectives is a real limitation of this section. (Michael MacCracken, Climate Institute)	We have edited to the text to no longer use the word "schemes".
326	35090	19	28	48	28	48	Changing the surface ocean albedo also has the potential for a large cooling, but we simply do not know if it is feasible. A reference to Chapter 7 (section 7.7) might be useful here. (Olivier Boucher, LMD/CNRS)	We have focused the section on approaches with literature on risks to society or ecosystems, so do not refer to this additional approach here.
327	35091	19	28	48	28	48	Is SRM really inexpensive? As compared to what? It should be made clear that you are only talking about the direct costs of operating SRM here. Moreover it is not clear to me at all if SRM is really so "inexpensive" in the long term, as in the absence of mitigation, the cost SRM and its impacts would ramp up. The first two references may provide cost estimates but are not the primary source of information for costing; the last reference is not peer-reviewed. (Olivier Boucher, LMD/CNRS)	We now cite a peer reviewed study on costs here (the first two citations support the description of the approach as large-scale and effective). An additional cost study is cited toward the end of the section.
328	35093	19	28	51	28	54	There are several issues with that sentence. While stratus cloud may be the most efficient cloud types for brightening, it is by no means the only clouds which have been considered. The sentence is also incorrect in that there would be some associated effects on cloud amount. Marine cloud brightening is not about inducing a Twomey effect only, so the end of the sentence needs some rewriting. Finally there would also be an aerosol effect in clear-sky, which is not so small as compared to the cloud effect. (Olivier Boucher, LMD/CNRS)	This text has been deleted.
329	35092	19	28	52	28	52	Note that chapter 7 is moving away from the old terminology of "direct" vs "indirect" aerosol effect. We are now talking about "aerosol-radiation interactions" and "arosol-cloud interactions", with their associated RF and AF. (Olivier Boucher, LMD/CNRS)	This text had been deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
330	35094	19	28	54	29	2	This sentence also has several issues. It is not gramatically correct to say "stratospheric aerosols require injecting sulfate aerosol precursors", you probably mean something like "Maintaining a stratospheric aerosol layer requires…". Then it does not have to be "sulfate aerosols" (other aerosol types have been considered) and it does not have to be "sulfate aerosol precursors" (it could be sulfuric acid aerosol), although you're right that injecting sulfate aerosol precursors is the most studied method. Finally stratospheric aerosols do not reduce incident solar radiation, but they increase the fraction of incident solar radiation that is reflected by the planet. (Olivier Boucher, LMD/CNRS)	This text has been deleted.
331	52227	19	29	4	29	4	Why are the risks all that is to be assessed? The whole intent of geo-engineering, is to create net benefits, or at least limit quite impactful harms (after all, the desired international response to climate change impacts is to completely change the global energy system). The whole framing of this section just seems totally in appropriate, ignoring the type of analysis that needs to be done, comparing whether it would be better to have, after all the mitigation and adaptation that is possible, climate change with or without climate engineering. While lines 6-8 present one sentence on benefits, this is just totally inadequate given the extensive attention give to potential inadvertent risks. (Michael MacCracken, Climate Institute)	See response to comment 312.
332	54343	19	29	6	29	8	Some of these benefits, specifically reducing or reversing melting of sea ice and ice sheets and increasing plant productivity and the terrestrial CO2 sink, seem to be results of offsetting warming while elevated CO2 concentrations are maintained. If so, these benefits are different than direct benefits of SRM itself (like cooling of the planet and beautiful sunsets) and should be distinguished. (Michael Mastrandrea, IPCC WGII TSU)	This text has been deleted.
333	35095	19	29	6	29	12	This looks like a copy-paste from Alan Robock's paper rather than a proper assessment of risks and benefits. Are red and yellow sunsets a worth mentioning benefit? Can you really control regional precipitation with stratospheric aerosols? What do you mean by "implications for mitigation strategies"? why is that a risk? What are the effects on airplanes (corrosion)? Why do you care about the electrical properties of the atmosphere? What are the other effects? (Olivier Boucher, LMD/CNRS)	This text has been deleted.
334	39927	19	29	6	29	12	references required (Peter Burt, University of Greenwich)	This text has been deleted.
335	52228	19	29	6	29	12	This is hardly an adequate explanation of the comparative risk analysis that would be done regarding SRM. The impacts that the intent is to alleviate are so large that they are forcing the reworking of the global energy system--that deserves more than a very meager sentence. Robock's listing of issues on both sides is similarly unbalanced, not nearly listing the severe impacts that would presumably be alleviated while listing every possible small inadvertent effect. This is not to say there are not potential adverse impacts, especially of such a crude implementation of the SRM approach as simulated and considered by Robock (and a number of others). Overall, a much more nuanced discussion is needed. (Michael MacCracken, Climate Institute)	This text has been deleted.
336	44739	19	29	6	30	7	This summary has been superceded by the WG I, Chapter 7.7 SOD, which surveys the latest SRM literature in much more detail. There is no need to reproduce the information here in terms of climate response, but rather to assess it in terms of vulnerabilities. And I don't know of any new work that has done that. (Alan Robock, Rutgers University)	The section has been shortened to avoid redundancy with WGI coverage of this topic.
337	52229	19	29	7	29	7	The whole point of reducing or reversing melting of ice sheets is to limit sea level rise, which is a potentially very severe impact--and not even mentioned here. (Michael MacCracken, Climate Institute)	This text has been deleted.
338	39926	19	29	8	29	8	move , from after 'sunsets' to after 'and' (Peter Burt, University of Greenwich)	This text has been deleted.
339	52230	19	29	8	29	8	While true there would be more beautiful sunrises and sunsets, listing it here without listing a huge number of other alleviated impacts is really making a mockery of the intent and potential value of SRM. (Michael MacCracken, Climate Institute)	This text has been deleted.
340	52231	19	29	8	29	8	What the model results indicate on precipitation is that SRM has the potential of reversing a large share of the precipitation changes, bringing them back toward the control case. This statement "control of regional precipitation" is hardly a good explanation of the results that have been found in model simulations. (Michael MacCracken, Climate Institute)	This text has been deleted.
341	52232	19	29	8	29	12	This list is really misleading. For example, "effects on ecosystems" fails to note that the huge beneficial outcome likely if global changes are not up by a few degrees C, which is projected to cause all sorts of damage, loss of biodiversity, reduced extinctions, and so on. Saying effects on stratospheric ozone and tropospheric chemistry does not give any context--even to the changes in chemistry occurring due to global warming, much less context with respect to other types of impacts. This issue of "rapid stopping" is really overstated--the Robock calculation, for example took the climate back to the 19th century and then stopped it--there would be huge impacts from the cooling he is proposing and the big increase he gets is from a colder condition no one would go to. The much more likely application would be a gradual onset to limit further warming or head toward a slight cooling, so this whole notion really comes from a very unlikely implementation. This notion on effects on airplanes and electrical properties of the atmosphere is all quite speculative--are there references at all quantifying these impacts or are these ideas just from Robock's list of issue to be investigated. That this list of risks is much longer than the potential ameliorated impacts is flat out misleading and gives a major misimpression. Yes, there may be some unintended consequences (note that virtually no effort has been made to design an application around them, so they are essentially worst case), but the ameliorated impacts, if the approach works as some models suggest, would be huge. (Michael MacCracken, Climate Institute)	This text has been deleted.
342	52796	19	29	10	29	10	Could be clearer what the risks/ implications for mitigation strategies are in this context. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	The text now includes discussion of risks associated with mitigation strategies.
343	35096	19	29	14	29	20	This paragraph repeats some of the previous paragraph. I suggest you combine the two and really assess what the risks are. There is no need for Figure 19.3 as there is a figure in Chapter 7 of WG1 on temperature and precipitation change from an idealised SRM deployment. The regional details would of course depend on the SRM scheme and its implementation. (Olivier Boucher, LMD/CNRS)	Text has been edited to focus on risk assessment. Figure 19.3 has been removed.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
344	38489	19	29	15	29	17	The way this is currently phrased and Figure 19.3 caption implies that volcanoes have been observed to cause drought over India and China. Is this the intention/correct? And that this is consistent with one geoengineering model study. But isn't the location of the forcing different in each case? (Claire Goodess, University of East Anglia)	The text has been edited to make clear that studies of the impacts of volcanic eruptions have been used as a analogue to the potential impacts of geoengineering.
345	52233	19	29	16	29	16	Using one of the valuable slots for figures for Figure 19-3 seems to me really misleading. There are a set of really important, almost unavoidable consequences of what is happening right now and will be hard to alleviate, and nearly no useful figures on them. The one on ocean acidification is rudimentary, at best; where is anything on the ice sheets melting, coastal inundation, methane coming from permafrost, more extreme weather. The choice to include a figure on a possible risk from an unlikely implementation of one of a set of possible approaches that would not be implemented without convincing evidence of far greater impacts makes a mockery of fairly treating geo-engineering and deflects attention from addressing the really central and nearly unavoidable risks the chapter is supposed to be covering. (Michael MacCracken, Climate Institute)	Figure 19.3 has been deleted.
346	39928	19	29	20	29	20	change 'tof' to 'to' (Peter Burt, University of Greenwich)	This text has been deleted.
347	35097	19	29	20	29	22	This sentence is irrelevant to the rest of the section. (Olivier Boucher, LMD/CNRS)	This text has been deleted.
348	35098	19	29	25	29	28	I suggest deleting this figure and referring to the relevant figures in Chapter 7 of WGI. This will leave some space to discuss risks adequately. (Olivier Boucher, LMD/CNRS)	Figure 19.3 has been deleted.
349	52234	19	29	25	29	28	While the change in precipitation might be interesting, what really matters is soil moisture and runoff. With lower temperatures, there would likely also be less evaporation and the might offset some or all of the reduction in precipitation--at least that question deserves attention and mention. Similarly, there are issues of whether the changes in rain are in extreme rain or not, and that can contribute both to soil moisture and runoff. Thus, this slide is really not very helpful at all in evaluating whether the change in precipitation is important or not. In that this figure is also for an unlikely implementation of SRM also makes it unsuitable to show. That it is also going from the present climate back to the early 19th century climate, as I understand the calculation in the citation, also makes it rather irrelevant. Further, the run is for a relatively short time, and so there was really no time for the ocean temperature to cool and reset the land-ocean temperature gradient (something that would happen with a slow onset of aerosol) also raises question about the whole point of the slide. I just see no basis for making this a really central part of the chapter or this section. (Michael MacCracken, Climate Institute)	This figure has been deleted.
350	35099	19	29	30	30	6	These four paragraphs are broadly correct but essentially repeat material covered in WGI. We would expect WGII to take the assessment of impacts and risks one step further and discuss the risks and benefits on e.g. agriculture in more depth. (Olivier Boucher, LMD/CNRS)	This text has been deleted.
351	51102	19	29	31	29	31	The author team might consider using summary terms for agreement (and evidence) given the description of agreement here. (Katharine Mach, IPCC WGII TSU)	This text has been deleted.
352	52235	19	29	33	29	38	Somewhere in this listing, our new study merits mention (see MacCracken, M. C., Shin, H-J., K. Caldeira, and G. Ban-Weiss, 2012: Climate response to solar insolation reductions in high latitudes, Earth System Dynamics, submitted prior to July 31, 2012 and published as a discussion paper at http://www.earth-syst-dynam-discuss.net/3/715/2012/esdd-3-715-2012.html.). In this study we examine Earth system response were the solar reduction to only be done in the polar regions, thus avoiding at least some of the inadvertent consequences cited in lines 9-13 while also exerting a cooling influence that spreads out from high to lower latitudes. Interestingly, while a schematic analysis in that the test was done by reducing the incoming solar radiation, this approach also has some beneficial influences in restoring polar snow and ice mass (so limiting sea level rise) and seems unlikely to be inhibiting the monsoon in the way that occurred for Robock et al.'s proposed implementation. It should at least be acknowledged that research might well moderate some of the suggested adverse impacts. (Michael MacCracken, Climate Institute)	We have decided not to cite this study given the refocusing of the section on risks to society and ecosystems, rather than physical consequences for the climate system.
353	52236	19	29	46	29	47	While it may be convenient to be talking about what happens to globally averaged precipitation, this is not really the variable to be considering. First, we would want to know the amount of precipitation over land, and, more important, what really matters are changes in soil moisture and runoff (among other factors like precipitation intensity distribution, etc.) and the reduction in temperature would reduce evaporation. That this might all matter can be gleaned from considering the global warming is leading to more precipitation globally, but also to more droughts, extreme rainfall and more, so total precipitation is really not the metric to be citing as mattering. (Michael MacCracken, Climate Institute)	This text has been deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
354	52238	19	29	46	30	3	At least somewhere in this litany, it needs to be indicated that seeking to reduce the global average temperature is only one of many possible objectives that could be pursued using any of the various SRM (or other approaches--for example, reducing cirrus clouds to increase LW loss as proposed by Mitchell). First, the objective could be to limit just summer warming--so putting aerosols into the summer hemisphere, or to adjust storm tracks (e.g., by having different latitudinal patterns of aerosols), or in primarily limiting polar warming and ice loss (as described in MacCracken, M. C., Shin, H-J., K. Caldeira, and G. Ban-Weiss, 2012: Climate response to solar insolation reductions in high latitudes, Earth System Dynamics, submitted prior to July 31, 2012 and published as a discussion paper at http://www.earth-syst-dynam-discuss.net/3/715/2012/esdd-3-715-2012.html; or in going after much more limited objectives, as described in (a) MacCracken, M. C., 2009: On the possible use of geoengineering to moderate specific climate change impacts, Environmental Research Letters, 4 (October-December 2009) 045107 doi:10.1088/1748-9326/4/4/045107 [http://www.iop.org/EJ/article/1748-9326/4/4/045107/erl9_4_045107.html]; and (b) MacCracken, M. C., 2011: Potential Applications of Climate Engineering Technologies to Moderation of Critical Climate Change Impacts, IUGG Expert Meeting on Geoengineering, 20-22 June 2011, Lima, Peru, pages 55-56 in Meeting Report, edited by O. Edenhofer, R. Pichs-Madruga, Y. Sokona, C. Field, V. Barros, T. F. Stocker, Q. Dahe, J. Minx, K. Mach, G.-K. Plattner, S. Schlömer, G. Hansen, and M. Mastrandrea, Intergovernmental Panel on Climate Change, Geneva, Switzerland. This section as a whole is just too narrowly focused in thinking about geo-engineering and needs to acknowledge in its closing paragraphs that the work to date is very limited and that there are many additional possibilities that cold alter the risk analysis. (Michael MacCracken, Climate Institute)	We have decided not to cite this study given the refocusing of the section on risks to society and ecosystems.
355	52237	19	29	48	29	51	As other of my comments have noted, I just don't think there is justification for making this point here. The case being examined is not a likely implementation at all, and the variable being looked at is just not the most appropriate one. It is fine to indicate that in a comparative risk analysis of potential climate engineering that there may be difficult tradeoffs, but that is not done here at all as there is no mention at all of the benefits that would be resulting from decision to go forward with an SRM implementation. Thus this is just a sentence describing one aspect of a much more complex analysis and is not at all giving context. (Michael MacCracken, Climate Institute)	See response to comment 312.
356	35102	19	30	5	30	7	It would be more useful to have a few conclusing sentences here rather than a paragraph on GeoMIP that says little. Schmidt et al (2012) is not a reference that says "few results are available". (Olivier Boucher, LMD/CNRS)	Text for this part of the section has been rewritten.
357	38490	19	30	18	30	21	Would it be possible to include a more comprehensive version of the table? Perhaps as supplementary material - just screening out things that do not meet the chapter definitions. Otherwise it's quite hard to know how selective/representative the things listed are. (Claire Goodess, University of East Anglia)	Yes, a more comprehensive version of the table is now included.
358	38938	19	30	54	30	54	Reference Levy 2009 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
359	39929	19	31	11	31	11	change 'case' to 'cases' (Peter Burt, University of Greenwich)	This has been corrected.
360	53793	19	31	24	0	0	This section could use a discussion of indigenous communities. (Kristie L. Ebi, IPCC WGII TSU)	Good point, however, due to limited space for the section and the fact that we know that other chapters deal with this point more in-depth, we were not able to include this discussion.
361	43789	19	31	24	32	3	Differential vulnerability dimensions are also highlighted for the example of dryland vulnerability at global scale including the differentiating effects of poverty (human wellbeing) and use of natural resources (Sietz et al. 2011a). REFERENCE: Sietz, D., Lüdeke, MKB. and Walther, C. (2011a) Categorisation of typical vulnerability patterns in global drylands. Glob. Environ. Chang. 21: 431-440. (diana sietz, Wageningen University)	The paper has been included in the new version of the chapter.
362	38939	19	31	34	31	34	Reference Peacock 1997 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference has been added.
363	46999	19	31	40	31	41	To underline these statement the following literature could be added Kienberger, S., Lang, S., Zeil, P., 2009. Spatial vulnerability units – expert-based spatial modelling of socio-economic vulnerability in the Salzach catchment, Austria, Nat. Hazards Earth Syst. Sci., 9, 767-778. http://www.nat-hazards-earth-syst-sci.net/9/767/2009/nhess-9-767-2009.html (Stefan Kienberger, University of Salzburg)	The source does not fit to the core message of the sentence, hence it is a useful source but not for the text on page 31 - line 40 and following
364	39930	19	31	41	31	41	insert , after 'general' (Peter Burt, University of Greenwich)	we think that the present sentence is correct - and hence we are not sure whether general would improve the meaning.
365	39931	19	31	43	31	43	change 'that' to 'those' (Peter Burt, University of Greenwich)	This sentence and section were modified.
366	43790	19	31	43	31	46	A recent study underlines differences in smallholder vulnerability to weather extremes in southern Peru (Sietz et al. 2011). Results are validated against an observed damage caused by weather extremes. The successful validation of these results clearly strengthens the scientific credibility of the findings and demonstrates their value for estimating expected damages caused by stress exposure. REFERENCE: Sietz, D., Mamani Choque, SE. and Lüdeke, MKB. (2011) Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano. Reg. Environ. Chang., Published online: 15 November 2011, DOI: 10.1007/s10113-011-0246-5. (diana sietz, Wageningen University)	The paper has been included in the new version of the chapter.
367	38491	19	31	46	0	0	This is a bit confusing - perhaps I'm not quite sure exactly which body of literature you're referring to - but most in this part of the text seem to be from 1990s - not particularly recent. (Claire Goodess, University of East Anglia)	The meaning is that it is relatively recent - hence more recent than the recognition of these issues in developing countries, hence I assume the wording is still appropriate.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
368	47000	19	32	6	0	0	The section on "19.6.1.3. Trends in Vulnerability" should not only highlight the fact that vulnerability changes over time (which is completly agreed) but should also highlight the issue, that the identification of vulnerability over time is needed to provide decision makers with appropriate information to evaluate their decisions/interventions and/or modify current policies. The need for monitoring vulnerability is also outlined in the paper: Kienberger, S., Zeil, P., 2005. Vulnerability Assessment and Global Change Monitoring: The Role of Remote Sensing - Potential and Constraints for Decision Support. 31st International Symposium on Remote Sensing for the Environment 2005, 20. – 24.06.2005, St. Petersburg, Russia (Stefan Kienberger, University of Salzburg)	We believe we do this effectively in SOD
369	47003	19	32	6	0	0	The section on "19.6.1.3.Trends in Vulnerability" is highly appreciated as it touches the time dependency and changes within time of vulnerability, but also provides a first set of criteria/domains within certain dimensions of vulnerability, which can later be 'monitored'. However, from a general impression somehow limited citations of literature is provided. There is a feeling that more scientific literature additionally exists next to those cited. This is a general impression and should be taken care of - hopefully the review process provides additional hints and resources of adequate publications. (Stefan Kienberger, University of Salzburg)	This section is already rather long and comprehensive, given that it is not the central focus of our chapter, which is about future risk.
370	43791	19	32	6	35	2	Given that quantification of vulnerability trends is often difficult due to the limited temporal resolution of available data, qualitative dynamic modelling approaches are useful to indicate relevant trends. As an addition to the dynamics of vulnerability mentioned in Section 19.6.1.3, changes in vulnerability are investigated at regional scale for drylands in Northeast Brazil based on qualitative dynamic modelling (Sietz, in prep. for Global Environmental Change Journal, based on Sietz 2011, Chapt. 5.2). Thereby particular emphasis is given to endogenous aspects of vulnerability changes in smallholder systems induced by trends in budget, labour allocation and quality of productive resources. This study presents a novel approach to assessing vulnerability by refining broad vulnerability patterns at global scale dynamically at the regional scale. This dynamic refinement enables the assessment of regional changes in the vulnerability-creating mechanisms. The identified typical vulnerability changes add mechanistic knowledge to the sparse observational data in Northeast Brazil and provide valuable insights for the prioritisation of intervention options aimed at improving environmental and living conditions. REFERENCES: Sietz, D. (2011) Dryland vulnerability - Typical patterns and dynamics in support of vulnerability reduction efforts, PhD Thesis, Faculty of Science, University of Potsdam, Germany, 135pp., Available at: http://opus.kobv.de/ubp/volltexte/2012/5809/pdf/sietz_diss.pdf ---------- Sietz (in prep. for Global Environmental Change Journal) Dynamic refinement of global vulnerability patterns at regional scale: Endogenous changes of smallholder vulnerability in Northeast Brazil. To be submitted to Global Environmental Change in September 2012. (diana sietz, Wageningen University)	Papers to be submitted can not be cited, however, the former papers suggested by Sietz and written by Sietz et al are reviewed and considered.
371	39932	19	32	9	32	9	change 'are dynamic and depend' to 'is dynamic and depends' (Peter Burt, University of Greenwich)	This sentence has been rewritten.
372	38492	19	32	18	0	0	Can you explain what the GINI index is and/or provide a reference? (Claire Goodess, University of East Anglia)	Text has been shortened - hence the GINI index example is not anymore integrated.
373	39933	19	32	18	32	18	define GINI and give reference (Peter Burt, University of Greenwich)	Text modified, hence GINI does not appear in this part
374	49181	19	32	18	32	18	Please explain GINI (Oyvind Christophersen, Climate and Pollution Agency)	Text modified, hence GINI does not appear in this part
375	49182	19	32	30	35	43	The trends in risks should be included in the executive summary, particularly institutional vulenerability, and the positive sign of reduced poverty at the global level (Oyvind Christophersen, Climate and Pollution Agency)	These are mentioned in ES but we cannot go into depth.
376	39159	19	32	32	32	51	Global trends in poverty are poorly represented here. While there has been a decline in the number of people meeting the description of outright poverty, there has been a trend of impoverishment of the midlle class in many countries as well, for example in the USA. This is not mentioned here, but it is relevant. Impoverishment of the middle class now potentially sets the scene for a massive rise in poverty in the near future. Growing global income disparity between rich and poor is reaching unprecedented levels, and this should be considered in more detail (in the relevant section on chpt 19 pg 33). (Thomas Reuter, University of Melbourne)	The point is correct, and the authors discuss the increasing divide between rich and poor also in the same section. For an in-depth discussion we would need more space and also refer to chapter 13 of this report - which deals particualrly with different facets of poverty and climate change
377	44834	19	32	32	32	51	It would be worthwhile to disaggregate the trends in poverty beyond the regional level, especially since this section almost immediately follows the one on differential vulnerability. What can we say about patterns in poverty related to gender, rural-urban, age, disability / health etc? Perhaps more sources can also be compared: for example, the UN Food and Agriculture Organization reported there were 925 million malnourished people in 2010, the same year Chandy and Gertz reported under 900 million people were poor - so if both were true, there would be 25 million people who were malnourished but not poor. Citation: FAO (2010). The State of Food Insecurity in the World: Addressing Food Insecurity in Protracted Crises. Food and Agriculture Organization of the United Nations, Rome (Carol Hunsberger, Institute of Social Studies)	OK these points were made and the new report of the FAO on The State of Food Insecurity in the World (FAO 2012) has been considered.
378	39934	19	32	34	32	34	change 'level' to 'levels' (Peter Burt, University of Greenwich)	No longer relevant, this text was rewritten.
379	51103	19	32	43	32	44	It might be helpful to clarify if the definition of poverty used in this statement is the same as that provided on lines 48-49. (Katharine Mach, IPCC WGII TSU)	The exact definition might change slightly, but the core message that at the global level poverty is going down is still confirmed and hence correct.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
380	38493	19	32	48	32	49	Does this definition just relate to this particular study? Perhaps need some discussion of the difficulties/different ways of defining poverty/poor. (Claire Goodess, University of East Anglia)	Correct, therefore additional sentences were inserted that also point towards the difficulties of a global trend, e.g. Does not account for national specifics, or changes in poverty between rural and urban areas etc. Moreover, chapter 13 focuses particularly and more in-depth on poverty, however, for this chapter we aim to report on global trends and changing vulnerability patterns, e.g. impoverishment of middle class groups in some countries or increasing income inequalities in countries in transition.
381	39935	19	32	49	32	49	reference required (Peter Burt, University of Greenwich)	References inserted
382	54345	19	33	2	33	6	Please specify the timeframe over which these changes have occurred. (Michael Mastrandrea, IPCC WGII TSU)	This whole paragraph has been modified and shortened
383	46970	19	33	6	33	11	In addition to sea level rise, a large number of population in Bangladesh are also vulnurable to drought and floods. (A K M Saiful Islam, Bangladesh University of Engineering and Technology)	This is correct, however, the point which we wanted to make is that sea-level rise is a good example; this does not mean that floods and droughts are not a problem as well. However, sea-level rise challenges for Bangladesh and Indonesia are more tellling and illustrative. This section has been modified in the Second Order Draft.
384	39936	19	33	14	33	14	delete 2nd 'of' (Peter Burt, University of Greenwich)	This sentence has been rewritten.
385	39937	19	33	17	33	17	insert , after 'example' (Peter Burt, University of Greenwich)	This section was rewritten.
386	53794	19	33	25	33	30	Please include consideration of developing countries. (Kristie L. Ebi, IPCC WGII TSU)	Has been shortened and modified
387	39938	19	33	26	33	26	delete , after 'intensity' (Peter Burt, University of Greenwich)	Has been shortened and modified
388	53795	19	33	32	33	38	Please provide more recent estimates. (Kristie L. Ebi, IPCC WGII TSU)	Has been shortened and modified
389	39939	19	33	36	33	37	reference required (Peter Burt, University of Greenwich)	Has been shortened and modified
390	47001	19	33	46	33	47	Here the units of Fahrenheit are used; needs to be changed (Stefan Kienberger, University of Salzburg)	Has been shortened and modified
391	39940	19	33	47	33	47	why use an out of date (and non-SI) temperature scale? At least give an equivalent value in Celsius (Peter Burt, University of Greenwich)	Has been shortened and modified
392	39941	19	33	48	33	48	delete 'out' and change 'nighttime' to 'night time' (Peter Burt, University of Greenwich)	Has been shortened and modified
393	38494	19	33	52	0	0	I don't recall SREX (at least Chapter 3) using the term/abbreviation EHEs. (Claire Goodess, University of East Anglia)	Has been shortened and modified
394	53796	19	34	1	34	3	Please include consideration of developing countries. (Kristie L. Ebi, IPCC WGII TSU)	Has been shortened and modified
395	51104	19	34	5	34	5	The author team should consider and potentially cross reference sections of Chapter 8 for this passage. (Katharine Mach, IPCC WGII TSU)	Has been shortened and modified
396	47002	19	34	21	34	23	"shrinking urban density"; it is not only the shrinking of urban densities, but also the demographic change of rural areas, which become 'unstable' in the sense of providing services because of a shift towards elderly population. As there in such areas not always real 'urban' areas, but more rural/villages the demographic change in rural areas should be mentioned - especially those which are marginalised due to limited economic developments/alternatives. This should not be oversimplified as there are also 'rural' areas available which grow or have a certain economic importance (e.g. tourist regions) (Stefan Kienberger, University of Salzburg)	Yes this is correct, however, the core message of the paragraph is dealing with "urbanization" therefore it would be not really plausible to add a larger paragraph here on the situation in rural areas. Moreover, the main point we want to make it that not only densly populated urban areas (e.g. megacities) pose a challenge to vulnerability, but also the opposite process, such as shrinking - which might also coincide with demographic change or socio-economic destabilization processes (high unemployment etc.)
397	41203	19	34	28	0	0	Section 19.6.1.3.2 pg 34 line 28 – presenting this section entirely through the lens of ecosystem services is too narrow. While there is mention of biodiversity (pg 34 line 53 and pg 35 line 1-2) in this section, given its role in underpinning well functioning ecosystems so they can provide services, a separate subsection should be presented here. Steffen W, Burbidge AA, Hughes L, Kitching R, Lindenmayer D, Musgrave W, Stafford Smith M and Werner P (2009) Australia's biodiversity and climate change: a strategic assessment of the vulnerability of Australia's biodiversity to climate change. A report to the Natural Resource Management Ministerial Council commissioned by the Australian government. CSIRO Publishing. Klausmeyer, Kirk R., M. Rebecca Shaw, Jason B. MacKenzie, and D. Richard Cameron. 2011. Landscape-scale indicators of biodiversity's vulnerability to climate change. Ecosphere 2:art88. http://dx.doi.org/10.1890/ES11-00044.1 (Susan Evans, WWF-Canada)	We believe biodiversity is now adeqautely covered, given the remit of theis chapter.
398	41204	19	34	28	0	0	Section 19.6.1.3.2 pg 34 line 28 – this section does not provide a balanced assessment of all ecosystem services types – heavily focused on the provisioning and regulatory types. (Susan Evans, WWF-Canada)	More can be added, however, the space is limited and even had to be shortened. Perhaps one needs to reconsider this point when the page length allows for additional input.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
399	54346	19	34	31	34	34	The quantitative basis for this statement implied by the use of "very likely" is somewhat unclear. Assigning a level of confidence may be more appropriate in this context. It is also unclear what time horizon is intended or if this is an open-ended statement. (Michael Mastrandrea, IPCC WGII TSU)	This statement could also be modified to a confidence statement, however, we are already seeing in various countries, such as the Philippines that societies that heavily depend on ecosystem services in coastal zones are affected by extreme events linked to or influenced by climate change. Consequently, it is also very likely that additional risks due to ecosystem service degradation will particularly affect rural societies and communities that depend on these services (e.g. in coastal areas).
400	49183	19	34	34	34	34	We do not understand "I part - and pacel" (Oyvind Christophersen, Climate and Pollution Agency)	This statement was removed.
401	39942	19	34	34	34	37	bad English, and references required (Peter Burt, University of Greenwich)	This section was rewritten.
402	53797	19	34	39	34	39	Is this inevitable? (Kristie L. Ebi, IPCC WGII TSU)	This statement was removed.
403	44835	19	34	41	34	43	This is the kind of detail I think would help show the magnitude of threats to ecosystem services on page 14 - in terms of the human rather than financial value of ecosystem services. (Carol Hunsberger, Institute of Social Studies)	This section was completely restructured and this sentence was removed.
404	39943	19	34	46	34	46	change 'are' to 'is' (Peter Burt, University of Greenwich)	Since the "number of" is referring to multiple things, it should take a plural verb, and thus we believe that our wording is correct.
405	44836	19	35	8	35	43	Perhaps some comments could be added about governance issues at scales other than the state level. (Carol Hunsberger, Institute of Social Studies)	Due to the limited space we rather had to focus on the main message - that governance playse a crucial role and here potential indicators at the national level could be the failed state index and the curruption level
406	51105	19	35	13	35	13	The author team should consider specifying the relevant sections of Chapter 12 here. (Katharine Mach, IPCC WGII TSU)	This section was restructured and the references to Chapter 12 were removed.
407	51106	19	35	36	35	36	The author team might consider a more qualified wording, in place of " alarming," would be appropriate here. (Katharine Mach, IPCC WGII TSU)	Thank you, we have modified this.
408	54347	19	35	42	35	43	The quantitative basis for this statement implied by the use of "likely" is somewhat unclear. Assigning a level of confidence may be more appropriate in this context. It is also unclear what time horizon is intended or if this is an open-ended statement. (Michael Mastrandrea, IPCC WGII TSU)	Modified - confidence statement at the end of the governance section
409	51107	19	35	43	35	43	The author team should consider if assignment of the likelihood term "likely" here reflects a probabilistic basis for assignment, as outlined in the uncertainties guidance for authors. If not, usage of the term in this context should be avoided. (Katharine Mach, IPCC WGII TSU)	See comment above.
410	39944	19	36	7	36	7	space required between number and units (Peter Burt, University of Greenwich)	Okay, thank you.
411	38495	19	36	24	0	0	It is not always clear in this section how some of the studies discussed are relevant to the particular issue of alternative development pathways. (Claire Goodess, University of East Anglia)	We have edited the text to make clearer the link between studies cited and alternative development pathways. Note that in some cases the point is understanding the relative contribution of climate change and socio-economic change to outcomes, which is a slightly different question.
412	47004	19	36	24	0	0	The section "19.6.2.1. The Role of Adaptation and Alternative Development Pathways" provides an overview of different studies in different contexts and domains of risk/vulnerability. The impression for this section is that it presents the different examples very isolated and lacks an additional 'common overview' and synthesis. This should be further strengthened. (Stefan Kienberger, University of Salzburg)	We have added text to the first paragraph that gives a broad synthesis of the specific results discussed in this section, and reorganized the rest of the section to make the principal points clearer.
413	48121	19	36	24	0	0	Section 19.6.2.1. presents a lot of different issues, and currently appears somewhat confused. The introduction most probably makes the right statement - that the relative importance of development and climate changes varies according to a number of factors, but this could appear more clearly as a conclusion, with each example assessed as clearly and accurately as possible. For example, the statements about sea-level (page 37) suggest that adaptation is possible, and even favour specific adaptation measures, but this is unlikely to be true in all regions (even in Europe) and all time scales (there is not time scale or magnitude of sea-level rise indicated). (Philippe Marbaix, Université catholique de Louvain)	We have added text to the first paragraph that gives a broad synthesis of the specific results discussed in this section, including those for adaptation, and reorganized the text around a set of more clearly defined issues.
414	39945	19	36	31	36	31	delete , after 'region; and delete 'period' (Peter Burt, University of Greenwich)	Done, although retained "period" for style purposes.
415	39946	19	36	33	36	33	the use of 'For example' introdcues a non seq (Peter Burt, University of Greenwich)	This phrase has been removed.
416	48125	19	36	37	36	38	How general are the conclusions from the quoted studies (Nelson 2010?) ? Is it possible to make such a general statement, independently of regions, time-scales, and emission scenarios ? Please clarify (would the statement about hunger be very different from the statement about water in the same paragraph?). Consistency with section 19.7.1, page 45 lines 11-13 also needs to be checked and clarified. (Philippe Marbaix, Université catholique de Louvain)	We have clarified the text to refer to aggregate impacts, and not in all scenarios.
417	48126	19	36	38	36	38	The reference Nelson (2010) is missing. (Philippe Marbaix, Université catholique de Louvain)	The reference has now been provided.
418	39947	19	36	41	36	41	degree symbol missing (Peter Burt, University of Greenwich)	Text deleted.
419	51108	19	36	51	36	54	The author team should consider cross-referencing chapter 4 of the special report on extremes here, as well as chapter 17 of this volume. (Katharine Mach, IPCC WGII TSU)	Reorganization of the text has made this citation unnecessary.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
420	39948	19	37	18	37	18	reference incomplete (Peter Burt, University of Greenwich)	Fixed.
421	48124	19	37	37	37	37	The reference Nelson(2009) is missing. (Philippe Marbaix, Université catholique de Louvain)	Reference added.
422	39949	19	37	38	37	38	style of citing temperature different to rest of chapter (Peter Burt, University of Greenwich)	Fixed.
423	39950	19	37	40	37	40	style and units (Peter Burt, University of Greenwich)	Fixed.
424	54348	19	37	44	38	27	Several other chapters are developing boxes or other text on the Representative Concentration Pathways and the Shared Socioeconomic Pathways. These include Chapters 1, 2, 20, and 21. It would be very useful to coordinate with them regarding descriptions of these pathways. (Michael Mastrandrea, IPCC WGII TSU)	This box has been deleted; material will be covered in other chapters.
425	53798	19	37	46	0	0	The information in this box is included in chapters 1, 18, 20, and others. (Kristie L. Ebi, IPCC WGII TSU)	See response to comment 424.
426	39951	19	38	14	38	14	delete , after 'sensitivity' (Peter Burt, University of Greenwich)	Text deleted.
427	49184	19	38	35	44	2	The readability might increase if this section is order according to the numbering of RFC as listed on page 7 (Oyvind Christophersen, Climate and Pollution Agency)	Done.
428	42920	19	39	1	39	29	Need to ensure consistency with chapter 4 p 28 lines 8-46 including figure 4.9 (see my earlier comment on the utility of this figure). Ch 4 seems to be distancing itself somewhat from the findings of AR4 on extinction risk and is very vague. It is inconsistent in tone with this section. (Cassandra Brooke, WWF-International)	Inconsistency with Ch 4 will be dealt with by encouraging colleagues in this field to provide review comments to Chapter 4, which we are aware they have not yet had time to do.
429	41205	19	39	3	0	0	Section 19.6.3.1 pg 39 line3 – I would have expected reference to arctic sea-ice systems in this section. Sea-ice systems are of extreme importance to the livelihoods of arctic peoples, are a primary driver of arctic ecosystem function, provide unique environments that are highly threatened by climate change (e.g. ice edge ecosystems), and the loss of sea-ice has been shown to be associated with climate feedbacks. (Susan Evans, WWF-Canada)	We have inserted a sentence and reference on the important role of sea-ice systems, cross referencing WGI.
430	39952	19	39	3	39	3	delete , after 'biological' (Peter Burt, University of Greenwich)	Grammar corrected
431	49185	19	39	27	39	29	This aspect should be emphasised in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	This issue is sufficienlty covered in revised ES
432	35438	19	39	32	0	0	This statement needs care and possible revision to be fully clear. If precipitation in the Himalaya region does not change, the annual average river discharge will not change, whether or not the glaciers retreat. However, the seasonality will certainly change, and may impact agriculture. (David Vaughan, British Antarctic Survey)	We have edited the sentence to specify precisely where in Asia is projected to be affected, citing work that has examined in detail where meltwater, rather than precipitation, contributes significantly to water supply. This addresses the reviewer's point that if precipitation remains constant, the water supply would remain unchanged. Further discussions with colleagues led to the explanation that the meltwater loss would be problematic if it affected dry season water supplies.
433	51109	19	39	45	39	45	It would be helpful to clarify further what is meant here by "modest changes." Modest changes in the assessment of these risks? (Katharine Mach, IPCC WGII TSU)	Text clarified.
434	38496	19	39	47	0	0	Not clear if 'this report' is SREX or AR5. (Claire Goodess, University of East Anglia)	Section rewritten to eliminate this text.
435	46099	19	39	47	39	48	I disagree with this assessment. I think there are differences and has also caused some controversy (see Cooney 2012) (Luis E. Garcia, World Bank)	This discussion has been entirely rewritten and the point eliminated.
436	53799	19	39	51	0	0	This section should explicitly state baselines. (Kristie L. Ebi, IPCC WGII TSU)	Baselines have been fixed.
437	41206	19	39	53	0	0	Section 19.6.3.3 pg 39 line 53 – I would have expected to see the Arctic mentioned in this section given the rate at which climate change is being felt across this region (rate of temperature increase outstrips anywhere else on earth) and the concentration of associated physical impacts being felt. The Arctic is definitely disproportionately affected from a biophysical impacts perspective. (Susan Evans, WWF-Canada)	Arctic was mentioned in two other sections of RFCs; too much material to mention everything everywhere.
438	51110	19	40	1	40	1	"High confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	This issue has been addressed throughout the document.
439	53800	19	40	1	40	6	Indigenous communities and knowledge could be considered. (Kristie L. Ebi, IPCC WGII TSU)	We discuss inidgenous communities in 19.4.3 and 19.6.3.
440	54349	19	40	10	40	11	The meaning of this last statement is unclear, since exposure is defined separately from vulnerability in SREX. (Michael Mastrandrea, IPCC WGII TSU)	This point was clarified.
441	49186	19	40	13	40	31	This aspect of risk of food security should be included in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Food secuity discussed amply in ES
442	35439	19	40	16	0	0	This statement needs care and possible revision to be fully clear. If precipitation in the Himalaya region does not change, the annual average river discharge will not change, whether or not the glaciers retreat. However, the seasonality will certainly change, and may impact agriculture. (David Vaughan, British Antarctic Survey)	This issue is now covered in 19.6.3.2 where magnitude of threat is quantified and issue of consequences of melting is clarified by specifying the particular regions affected.
443	54350	19	40	30	40	31	Can the magnitude of these negative effects be quantified? (Michael Mastrandrea, IPCC WGII TSU)	This issue is now covered in 19.6.3.1 where magnitude of threat is quantified and issue of consequences of melting is clarified by specifying the particular regions affected.
444	39953	19	40	31	40	31	style and units (Peter Burt, University of Greenwich)	Thank you. This issue was addressed throughout the document.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
445	52239	19	41	1	41	2	These numbers who would be displaced seem to me far too low--perhaps because they only consider the population in the 2 m or lower coastal plain. But if SL is up 2m, then storms will take surges much further inland and so there is a need to count those over a much greater area. After all, the hurricane Irene surge to less than 2 m in NYC closed the whole cities subway system and would have displaced a good many people if that level had been maintained--and not just those actually now below sea level, but in a wider zone that would be used for protection. The Sacramento/San Joaquin delta also represents a huge area that would be flooded with a 2 m rise unless there was substantial (very substantial) investment in protection. For the US, the March 2012 paper by Strauss et al. is likely the most detailed indication of vulnerability and impacts, and it would be interesting to have a comparison of that paper with the one cited. (Michael MacCracken, Climate Institute)	The Nicholls et al. (2011) analysis uses a threshold of being flooded more than once a year as the threshold for displacement. Now noted.
446	52248	19	41	8	41	9	It seems to me that a different way of thinking about the (social) cost of carbon is to figure out what the impacts are to be avoided, such as 2 C as decided upon by the world's leaders based on the risks arising from the potential for rapid and nonlinear changes, and then ask what the cost would be of making the energy transformation needed to accomplish this. In some sense, this is the real cost to society of what they are doing--that is, we have made a choice of energy systems over the past that is going to require society to invest this much to change to a climate-safe path (or as safe as a 2 C upper limit would provide, which is not very safe, in my view). (Michael MacCracken, Climate Institute)	This is not the social cost of carbon, nor a measure of aggregate impacts; it is a shadow price of carbon, and should be addressed by Working Group 3. The argument the reviewer is making here is analogous to one made by Baumol (1972), and has considerable merits. Nonetheless, it does not inform assessments of the social cost of carbon.
447	52240	19	41	9	41	9	It needs to be made clear that the "social cost of carbon" really has nothing to do with the impacts on social systems, etc.--this is a quite specific economic analysis of potential costs but does not count, for example, aspects such as the climate of Sweden becoming like that of Spain on society, culture, and the like (more to the point, it might calculate the overall economic cost relating to food production, but none of these estimates, to my knowledge, give any notice or account of what the dislocation to farmers and farm communities might mean as the climate shifts). The term, as I understand it, was invented during the Reagan Administration and is really an estimate of the (net) economic cost of impacts, and really does not justify the adjective "social" in any way. Also, the results are not at all "estimates of global aggregate impacts" in that not nearly all types of impacts are considered, and the results are really only the "economic" aspects--so not deaths, but the imputed value of deaths, etc. (Michael MacCracken, Climate Institute)	The term "social cost" has a specific economic meaning, with most of the discussion originating with Coase (1960). The models used to calculate the SCC generally do attempt to monetize non-market damages in some fashion, though uncertainly in these estimates is large.
448	52242	19	41	10	41	10	As indicated on page 4, lines 8-11 and in the following sentence here, there are many indications that the estimates that have been done are underestimates. I think it misleading to the reader to really start out by featuring in the paragraph the results that are known to be (seriously) flawed and to hide the key result in the second sentence. What it seems to me we have learned over the past few years is that impacts are occurring more rapidly and significantly than previously projected, so impacts (e.g., of extreme weather) are occurring with greater magnitude and at an increasingly rapid rate. Even if the models were correct, what has only increased modestly might be the cost of impacts for a given increase in global average temperature in these inadequate models--what has been happening in reality is that actual impacts have been increasing more than modestly; the phrasing here is just incomplete, and yet ends up being featured because the inadequate underestimates of these models are presented in the featured sentence in this paragraph. (Michael MacCracken, Climate Institute)	We have assessed the literature that is available and pointed out its shortcomings and uncertainties. We see no alternative to this approach.
449	52246	19	41	10	41	10	Specifically on this statement of "increased modestly", how can this be the conclusion when the Interagency WG on Social Cost of Carbon used IAMs of roughly 2005 vintage and got an estimate of about $20/ton for the social cost of carbon that was a factor of 5 less than what the IAM groups said their current models were giving? It seems to me that what is being found is that the impacts, and so costs, are occurring earlier and more severely than had been projected in the past, such that there has been a quite significant sense of what the impacts are costing. (Michael MacCracken, Climate Institute)	This paragraph does not discuss the social cost of carbon (a measure of marginal impacts), but aggregate damages. The reviewer is mistaken about the U.S. government analysis. It used models of 2009 vintage (specifically, DICE 2007; PAGE 2002; and FUND 3.5), and Table 19-4 shows that its estimate of ~$25/ton CO2 is consistent with the modelers' preferred results, if in fact a bit higher. The differences are not due primarily to significant changes in aggregate damages, but instead to differences in assumptions about discounting and scenarios.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
450	52241	19	41	10	41	11	The study by the Interagency Working Group on the Social Cost of Carbon is clearly inadequate. That this is the case only requires reading the report, especially all the comments included at the end. In addition, the USDOE and USEPA held a conference on the report (well, to be on what could be done better, but it highlighted the shortcomings), and the authors of the models that the Interagency Group used reported at that meeting (and I was there) that out-of-date versions of their models had been used and that rather than the $20 per ton the Interagency Group estimated, current versions of their models would give about 5 times that value (the set of materials and report from the USDOE/USEPA conference are accessible at http://yosemite.epa.gov/ee/epa/eerm.nsf/vwRepNumLookup/EE-0566?OpenDocument). In the Interagency WG implementation, their use of the Nordhaus model had something like a 10 C global warming only having a 30% impact on global GDP. This is just clearly absurd on its face--the world has never been this warm, and indeed, at only perhaps half this increase, polar ice would have melted and SL would be higher by 70-80 meters, flooding most of the world's largest cities. One key problem of that study was how much they left out, and another the discount rate. Drawing a trend conclusion from such an incomplete study compared to the Stern report, etc. makes no sense at all. I would also note that none of these models really accounts for the risks of sudden and rapid climate change or ocean acidification (presumably supposed to be a major part of this chapter), and yet the political leaders have been convinced by the science to limit global climate change to less than 2 C (and a number of scientists would suggest that impacts happening now mean that 2 C is too high a value given the risks and impacts). So, how is that conclusion consistent with the results presented in Figure 19-5? Frankly, the curves in Figure 19-5 are just not consistent with the results described in the impact chapters, mainly because most of the models do a terrible job of really representing impacts--in many case the estimates are mainly (or were mainly) pulled out of the air and implemented with an arbitrary curve fitting. Somehow, the many problems are just not discussed, or at least are swamped by the impression given by the figure, which represents results for only a few aspects of what climate change would really mean. And in no way do they consider the "social" aspects of the impacts. (Michael MacCracken, Climate Institute)	The revisions place a greater emphasis on the lack of agreement among models, and Figure 19-5 has been modified to highlight the uncertainty in estimates.
451	52243	19	41	12	41	14	This sentence should be the first one in the paragraph--it is clearly the most important point in the paragraph. Examples should be given of the many important non-quantifiable impacts that are not being treated, not forcing people to go hunt them out. What is left out is really vital to indicate--not doing so is like what happened with the IPCC AR4 WG I estimate of sea level rise, where they presented quantitative results that left out what is very likely to be the major term over coming decades because they did not know how to make the calculation. (Michael MacCracken, Climate Institute)	The text has been modified and we hope gives proper emphasis to important conclusions.
452	52244	19	41	14	41	17	This sentence is also very important and should be a subject sentence of a separate paragraph and not hidden in this paragraph. (Michael MacCracken, Climate Institute)	The text has been modified and we hope gives proper emphasis to important conclusions.
453	52245	19	41	17	41	19	This statement should be right up with the sentence about the estimates presented in lines 9-12--why in the world is this important finding about the results separated from the finding they apply to, and perhaps this sentence should come before the earlier one. (Michael MacCracken, Climate Institute)	The text has been modified and we hope gives proper emphasis to important conclusions.
454	52247	19	41	22	41	28	Why in the world devote a figure to results of models when there is high confidence that these models are giving estimates that are too low? That makes no sense to me given the attention that figures will give. If a figure like this is to be included, at the very least given some error bars and an indication of where it is estimated that the values really are. (Michael MacCracken, Climate Institute)	The figure now more clearly highlights the uncertainty.
455	52249	19	41	31	41	37	Again, given there is high confidence the models are under-estimating, why feature the results they get rather than what they are leaving out. At the very least show some indication of uncertainties in these results (I don't think WG 1 would allow this type of graph, with no uncertainties indicated). On the DICE model, its parabolic impact relationship, this seems far too simple to be using, and that it (at least an early version) got only a 30% GDP effect for a 10 C temperature increase, given all the extinctions, etc., just makes it really suspect. And the FUND results are clearly inadequate. I just do not think that giving the attention that a figure gives to results that are so incomplete makes any sense at all. Find to do in a scientific paper, but not in the IPCC assessment. (Michael MacCracken, Climate Institute)	The figure now more clearly highlights the uncertainty.
456	39954	19	41	33	41	34	style of referencing wrong (Peter Burt, University of Greenwich)	Style appears to be correct.
457	54351	19	41	39	41	46	It would be useful to coordinate with Chapters 10 (10.9.2) and 18 (18.4.2), where this topic is also discussed. (Michael Mastrandrea, IPCC WGII TSU)	There is some overlap (although not complete) with these two chapters, and cross-references to them have been added.
458	43370	19	41	48	42	4	The following study is relevant in this context and should be cited: Hans-Martin Füssel: Modeling impacts and adaptation in global IAMs. WIREs Climate Change 1:288-303, 2010. DOI: 10.1002/wcc.40 (Hans-Martin Füssel, European Environment Agency)	This reference has been added.
459	52250	19	41	48	42	4	Indeed. So, here is an explanation of why the models are simply inadequate. Why in the world have this result so far, actually why have it after, the description of what the model results are--it gives the impression that these don't really matter, when indeed they are the most critical aspects in considering their results. This whole section seems to be in an inverted order. I would also suggest that this paragraph makes clear why the adjective "social" is just not justified and IPCC should not just adopt a bad terminology convention. Basically, the section should make clear that such an estimate is very hard to make, that the closer one looks the greater the impacts (a result California impact study documents), that lots is left out, etc., and then that despite all this, the results nonetheless justify the costs of mitigation. I just think the overall section needs redoing. (Michael MacCracken, Climate Institute)	The section has been restructured.
460	49187	19	42	6	42	6	We think that the SCC index should be briefly explaind (Oyvind Christophersen, Climate and Pollution Agency)	The text gives a brief explanation of SCC.
461	39955	19	42	7	42	7	delete , after 'time' (Peter Burt, University of Greenwich)	Done.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
462	39956	19	42	11	42	11	move (to before '2' in 2005 (Peter Burt, University of Greenwich)	Done.
463	38498	19	42	13	0	0	Perhaps somewhere in this paragraph it is worth saying explicitly that this is largely due to the increase in upper estimates. (Claire Goodess, University of East Anglia)	Paragraph has been rewritten.
464	38497	19	42	17	42	18	It seems a bit odd to say that uncertainty is due to the under-representation of uncertainty. Maybe better to first discuss the things that are represented - and then note there are things that are not. (Claire Goodess, University of East Anglia)	Text has been restructured.
465	52100	19	42	41	42	42	For the definition of "large-scale singularities" and "tipping points" here, it would be beneficial to also reference the entries in the report glossary. (Katharine Mach, IPCC WGII TSU)	Tipping points is now in the glossary.
466	51111	19	42	46	42	46	"Medium confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Corrected.
467	35453	19	42	51	0	0	Not quite true, Greenland contributes more - see WGI Ch4 (David Vaughan, British Antarctic Survey)	Corrected.
468	52251	19	43	1	43	2	This sentence really misses the point--it is really more typical of how not to pose a question to scientists than one that provides insight to the issue at hand. Scientists take words literally, and yes, a "complete" melting of the Greenland ice sheet may require more than 2 or 4 C, but the real issue is how much will be melting with a 1-2 C change, and if that is even just a quarter or a half, that would cause devastating impacts. What we are seeing now is unprecedented melting and ice loss and we are only at 1 C. (Michael MacCracken, Climate Institute)	While the point is well-taken, this section is about largescale loss of ice. There is a literature gap on temeprature dependence between near-complete loss and gradual loss due to change in surface mass balance.
469	39957	19	43	2	43	2	degree symbols missing (Peter Burt, University of Greenwich)	Corrected.
470	53801	19	43	23	43	23	Transformation to what? (Kristie L. Ebi, IPCC WGII TSU)	Expanded explanation given.
471	48123	19	43	30	0	0	Section 19.6.3.6. This section explains a limitation of the use of RFCs to date, but nothing better is shown. The approach has limitations (that are noted in Smith et al 2009), but does it still provide some policy-relevant information ? If so, this should be made clear. It could be interesting to provide alternative versions of the colour bars linking each RFC (and/or other risk metrics) to temperature, corresponding to variants of vulnerability, thus keeping a (partly) quantitative view on risks. Please see also my comment on chapter 19. (Philippe Marbaix, Université catholique de Louvain)	We have modified this section, and moved it to become the first subsection within 19.3.6 (Reasons for Concern) in order to better frame the discussion, explain the limitations of past RFCs, and illustrate an alternative version of the Burning Embers diagram that offers a new way forward to address key limitations.
472	54352	19	43	30	0	0	Section 19.6.3.6: Will the author team attempt to update an RFC-like figure in this context of differences across development pathways? A challenge, to be sure, but possibly a useful visual tool as well. The TSU, in particular Yuka and Monalisa, stand ready to provide technical support for graphics development if this would be desired. (Michael Mastrandrea, IPCC WGII TSU)	We have updated the burning embers diagram for each RFC, and in addition offer an alternative diagram illustrating a new approach to displaying this figure that is explicit about dependence on vulnerability. The text then supports the degree to which these distinctions can be made based on existing literature.
473	43371	19	43	33	43	34	The reference to the TAR is incorrect. It should be Smith et al. 2001 rather than 2009. (Hans-Martin Füssel, European Environment Agency)	Done.
474	49188	19	44	5	44	5	Which risks are "these" pointing back to? (Oyvind Christophersen, Climate and Pollution Agency)	Removed.
475	46100	19	44	5	46	32	Shouldn't this be in Chapter 20 instead? I wonder if the same could be said about sections 19.7.3 (line 5 page 48), 19.7.4 (line 13 page 49), and 19.7.5 (line 1 page 50). Aren't these "what to do" discussions? (Luis E. Garcia, World Bank)	In these sections we assess literature on the implications of key risks and vulnerabilities for response options, which is part of the chapter's remit. Also, it is in the plenary outline.
476	39958	19	44	12	44	12	delete , after 'ecological' (Peter Burt, University of Greenwich)	Done
477	54353	19	44	37	4	39	As commented in the context of the Executive Summary, this requires further explanation. Are the labels of "most rapidly" and "least rapidly" simply relative among the items considered here? This seems to be implied by the rest of the paragraph, and should be clarified. In addition, is a schematic figure possible to illustrate the point? (Michael Mastrandrea, IPCC WGII TSU)	Clarification and Figure added
478	52252	19	44	39	44	41	The paper by Wigley (Wigley, T. M. L., 2005: The Climate Change Commitment, Science, 307, 1766-1769 DOI: 10.1126/science.1103934) merits mention here; he really pioneered this analysis. (Michael MacCracken, Climate Institute)	Reference is 2005. Not sure if OK to cite. Space is limited. Simply talks about commitment to slr and needing more mitigation to deal.
479	48128	19	44	47	45	5	The reference "Arnell et al 2012" is missing. If the associated peer-reviewed publication is not approved for publication before the cut-off date, and the authors wants to have this figure included based on non peer-reviewed literature (after reaching the conclusion that no suitable alternative is available), it is even more important to assess the quality and limitations of the shown data (please see my specific comment on p44 line 49-50). (Philippe Marbaix, Université catholique de Louvain)	Reference is now peer reviewed and published.
480	48129	19	44	49	44	50	(related to text and figure 19-8) I am concerned that this particular example is based on a post peak emission reduction rate of 5%, which is extremely optimistic, if not purely theoretical. A more realistic example is needed, either as a supplement or a replacement. (Philippe Marbaix, Université catholique de Louvain)	Fragmentary comment - we do not understand
481	51112	19	44	51	44	51	It would be helpful to clarify this percentage range with respect to figure 19-8. (Katharine Mach, IPCC WGII TSU)	We have now ensured that the text and the figure match.
482	49189	19	44	53	44	54	Please include this aspect in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Avoided impacts now discussed in ES.
483	52798	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. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	The original section on limits to adaptation has been greatly reduced (and now appears as 19.7.5) as this material is assessed in detail in Chapter 16.
484	54354	19	45	19	45	21	Are these 3 to 4 decades the delay in time before the same temperature increase is reached? It would be helpful to clarify this. (Michael Mastrandrea, IPCC WGII TSU)	Yes, clarified.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
485	39160	19	45	31	45	54	This section is extremely important for anyone who would like to know what will actually happen, or is most likely. The reality seems to be (having just attended Rio+20) that there is little political will to push mitigation to the limit of what is technically and economically possible. I would like to see a graph that demonstrate the effect on various partial failures to maximise mitigation, notably those listed in this section. I also think there is an urgent need to start monitoring and tallying the actual mitigation efforts made by governments around the world, so that we have the ability to compare ideal / hypothetical scenarios with actual mitigation continuously. (Thomas Reuter, University of Melbourne)	We agree the topics mentioned by the reviewer are important but will be addressed by WG3. Here we focus only on limits to mitigation, rather than more nuanced assessment of likelihoods of various degrees of mitigation.
486	39959	19	45	36	45	36	degree symbol missing (Peter Burt, University of Greenwich)	Done.
487	39960	19	45	41	45	41	degree symbol missing (Peter Burt, University of Greenwich)	Done.
488	39961	19	45	49	45	49	degree symbol missing (Peter Burt, University of Greenwich)	Done.
489	39962	19	46	5	46	5	degree symbol missing (Peter Burt, University of Greenwich)	Done.
490	53802	19	46	22	46	32	Please ensure consistency with material presented earlier in the chapter. (Kristie L. Ebi, IPCC WGII TSU)	This paragraph and others on adaptation were heavily shortened and most of the inconsistancies have been removed.
491	39963	19	46	25	46	25	degree symbol missing (Peter Burt, University of Greenwich)	The text was carefully reviewed for this issue.
492	39964	19	46	28	46	28	degree symbol missing (Peter Burt, University of Greenwich)	The text was carefully reviewed for this issue.
493	39965	19	46	37	46	37	text missing (Peter Burt, University of Greenwich)	This section was completely rewritten, and this sentence no longer appears in the text.
494	49190	19	46	37	46	47	We think that the consept of residual changes and it's relation to dangerous climate change should be elicitated in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Residual damages is indeed mentioned in the ES, but not explicitly in relation to dangerous climate change. The comparison might be possible in the FGD, the figure is still under development.
495	38940	19	46	42	46	42	Reference Stern 2007 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference was added.
496	53803	19	46	43	46	43	And mitigation. (Kristie L. Ebi, IPCC WGII TSU)	This section was rewritten. The new section (19.7.1) discusses the relationship between adaptation, mitigation, and residual impacts at length.
497	51113	19	47	3	47	3	"Medium/low confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	This issue was addressed throughout the document.
498	52253	19	47	10	47	13	Good examples of problematic areas in which to use levees and retreat would seem to include parts of New York City, areas abutting Chesapeake Bay, and more. (Michael MacCracken, Climate Institute)	This section was completely rewritten and restructured.
499	39966	19	47	11	47	11	change 'meter' to 'metre' (Peter Burt, University of Greenwich)	This sentence was removed.
500	39967	19	47	26	47	26	delete , after 'barriers' (Peter Burt, University of Greenwich)	This sentence was removed.
501	51114	19	47	28	47	29	For this definition, it would be helpful to clarify the intended interpretation. In parsing the sentence, should the reader consider "where biophysical change threatens a valued ecosystem service" as parallel to "in which an actor's objectives and values can no longer be secured from unacceptable risks through adaptive action" or simply to "through adaptive action"? (Katharine Mach, IPCC WGII TSU)	This section was completely restructured and this sentence was deleted.
502	39968	19	47	42	47	42	bad English. Don’t start sentence with 'And' (Peter Burt, University of Greenwich)	This section was rewritten.
503	49191	19	47	46	47	47	We think that the perception of limits to adaptation should be elicitated in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Thank you, this is a good point. We will consider this for the FGD, however, we still have to check which limits should be highlighted considering the specific chapter on limits of adaptation in the report.
504	39969	19	48	1	48	1	bad English. Don’t start sentence with 'But' (Peter Burt, University of Greenwich)	This section was rewritten.
505	46957	19	48	5	49	13	Apparently there is still no consideration of tipping points that have been crossed or are close to being crossed causing a domino effect of further tipping points to be crossed. Given teleconnections in the Earth System physical proximity of tipping points and potential tipping points is not crucial factor; however, artic sea ice melt is likely to have an effect on permafrost melt and the rate of melting of the Greenland ice sheet. Given demonstrated past under estimates of these changes it is hubris to assume that domino effects will not be seen given that there is no analogue to the stress that humans are causing the Earth System. It is similarly hubris to assume that all tipping points in the Earth System have been identified (Charlesworth and Okereke, 2010). (Mark Charlesworth, Keele University)	The text has been edited to avoid misunderstandings. The original text was not intended to convey that all potential threshold responses have been identified or that they do not interact. The references cited in the text contain discussions of this.
506	54259	19	48	11	48	37	Very similar text appears in Chapter 16 (page 7), and the text should be compared to reduce redundancy. Another option would be to jointly develop a Box that would appear in both chapters. (Michael Mastrandrea, IPCC WGII TSU)	This comment does not apply to the indicated page/lines.
507	51115	19	48	28	48	28	"Low confidence," as calibrated uncertainty language, should be italicized. In addition, would a word such as "levels" be clearer than "location"? (Katharine Mach, IPCC WGII TSU)	“low confidence” is now in italics. In our judgment the wording of “location” is preferred to the suggested “level” as this is (a) clearer and (b) seems easier to extend to more complex analysis frameworks where the separation between triggering and not triggering a threshold is located in a more complex space (e.g., with an additional dimension of the time spent above a certain temperature limit).

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
508	52254	19	48	28	48	29	While there is uncertainty where the threshold will be, it should also be noted that, given recent changes on the Greenland and Antarctic ice sheets (i.e., 97% of surface of GIS showing some July melting, increasing loss of mass rather than buildup as projected for Antarctic ice sheet in previous assessment, breaking off and thinning of ice shelves and faster flow of glacial streams after this occurs, etc.), this threshold may well be very near, or even already passed. Just saying something is uncertainty without giving a reasonable indication of where it might be is copping out on expressing what scientific results are suggesting. (Michael MacCracken, Climate Institute)	The text does already discuss climate thresholds that are quite "near" (e.g., on lines 18-51), but is not very explicit about their location, so text has been edited to indicate that they may be close and link to the related discussion in section 19.7.2.1. We have also edited the text to make clearer that some thresholds may already have been passed (see also reponse to comment 505).
509	54355	19	48	46	48	46	Was this a specific business as usual scenario that can be identified by name? (Michael Mastrandrea, IPCC WGII TSU)	There is no specific business-as-usual scenario that can be easily identified by name (e.g., by a reference to the SRES). This statement refers to the business-as-usual scenario from the integrated assessment model cited in the original text. Explaining this detail would seem to go beyond the scope of this synthesis. This is detailed in the cited and peer-reviewed paper
510	51116	19	49	4	49	5	"Low confidence," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	"low confidence" in now in italics.
511	52101	19	49	15	49	16	For the definition of "tipping points" here, it would be beneficial to also reference the entry in the report glossary. (Katharine Mach, IPCC WGII TSU)	We referenced the glossary
512	39500	19	49	17	0	0	until recently' puts a lot of emphasis on what is still a rather weakly evidenced hypothesis about warning systems (I presume this relates to the changed-variance pattern approach to assessing imminent regime shifts - in which case we still really only know with hindsight what we should have been looking for...) - given observation and monitoring systems for most ecosystem processes and functions are still rudimentary, most tipping points are still not foreseeable. (Sarah Cornell, Stockholm Resilience Centre)	We have changed 'can give warning' to 'may give warning' to reflect the reviewer's comment that the evidence is still weak.
513	39501	19	49	25	0	0	May be avoided, rather than can be avoided - again, a precautionary line is given more firmness here than it really merits. The system is complex, and our understanding demands simplification. The point is that there will always be contingency. Past studies can reduce some of the uncertainty, but predicting and managing 'exact levels of climate change that ecosystems can withstand' is not possible. (Sarah Cornell, Stockholm Resilience Centre)	We have decided to leave the sentence unchanged since it actually reads, that if the level of climate change could be reduced, the impacts could be avoided. Since we do not specify by how much the climate change might be reduced, it is still valid to say this, even though in practice sufficient mitigation might be infeasible.
514	49192	19	49	25	49	52	The important message that response strategy ii is not sufficient when certain threshold are met, and that regime shifta have already taken place should be included in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	Thresholds are now mentioned in ES.
515	51117	19	49	28	49	31	The author team should consider and cross-reference relevant sections of chapters 6 and 30 for these statements. (Katharine Mach, IPCC WGII TSU)	Cross referencing chapters 6 and 30 completed.
516	41207	19	49	38	49	52	Section 19.7.4 pg 49 line 38-52 – Clarity is needed at the start of this paragraph on how managing for resilience can help ecosystems avoid tipping points. Currently it talks about a type of threshold, but doesn't explain how taking a resilience based management approach would help avoid that threshold. Walker, B. and D. Salt. 2006. Resilience Thinking: Sustaining ecosystems and people in a changing world. Island Press, Washington. (Susan Evans, WWF-Canada)	Request to include additional reference and clarify need for resilience based management. Text edited accordingly.
517	38941	19	49	39	49	39	Reference Allen et al., 2012 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference was added.
518	39970	19	49	49	49	49	delete 'a' (Peter Burt, University of Greenwich)	Grammar – done.
519	41448	19	50	0	0	0	the chapter on governance misses out the processes on the international level which try to govern the risks related to climate change. Why it would not be appropriate here to repeat many international governance aspects which have been addressed in other chapters, it would be the adequate place to address the international policy debate on loss and damage, since the term is often referred to in the chapter. With the adoption of the Cancun Adaptation Framework at COP16 in 2010, this issue is emerging. In 2012, a UNFCCC work programme consisting of several regional expert meetings seeks to improve assessment and understanding of loss and damage associated with climate impacts as well as approaches to address them, leading into a potential COP decision and further steps at COP18 in Qatar in 2012. While the specific governance model applied under UNFCCC remains under discussion, it is definitely a starting point for an international governance approach to loss and damage. See e.g. www.lossanddamage.net or http://unfccc.int/adaptation/cancun_adaptation_framework/loss_and_damage/items/6056.php (Sven Harmeling, Germanwatch)	The international area and governance regimes to address loss and damage are diverse and can not sufficiently be captured or described by the current adaptation framework on loss and damage of UNFCCC, hence it would take at least 1 page to discuss these global governance regimes in a scientifically robust way. Moreover, the effectiveness of different governance systems, like the Linking Disaster Relief, Rehabilitation and Development have also quite different scuccess and failure rates in different countries. Overall, the point of this sub-chapter is to underscore the importance of governance as a factor that either enhances vulnerability and risk or rather helps to reduce it. The majority of scientific papers that exist and can be assessed by the IPCC is linked to national governance (failures) and their role in destabilization processes and risks to climate change and natural hazards. - It might be good to revisite this point again.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
520	41208	19	50	1	0	0	Section 19.7.5 pg50 line 1 – this section appears heavily weighted towards developing nation governance strategies. (Susan Evans, WWF-Canada)	Yes in part the section outlines major govrnance challenges in developing countries (since they seem to be directly linked to certain vulnerabilities identified), however, also challenges for governance in so called developed contries in the context of risk reduction and climate change adaptation are considered, e.g. Sources such as Greiving; Fleischhauer 2012 or Löfstedt 2005 or Greiving et al. 2012 and Ernst 2004 are authors and paper that address and discuss governance problems in the context of climate change and risk reduction in industrialized countries.
521	42770	19	50	1	0	0	Section 19.7.5: This section focuses on Africa (and by implication, developing/underdeveloped countries) to the exclusion of developed countries. Governance failure exists in developed countries as well, and this should be acknowledged and discussed. For example, the United States has been experiencing failures at the state and federal level in incorporating data on sea level rise, and this failure has been embodied in laws such as the National Flood Insurance Program and the recent, well-publicized law enacted in North Carolina that will limit the government's ability to properly use new information on emerging risks. Land-use planning at the state and local levels also is a key factor in incentivizing or constraining/impeding adaptation. In this context, it would also be helpful to have a discussion of the role of laws and the legal system at the national and subnational level in creating, exacerbating, or reducing key vulnerabilities, as well as the way that legal systems themselves can be seen as key vulnerabilities. (Sean Hecht, UCLA)	The section on governance was heavily modified and shortened, However, both governance failure and challenges in developing as well as in developed countries are mentioned also under the sub-chapter on institutional vulnerability.
522	43372	19	50	1	0	0	Section 19.7.5 uses two full pages to discuss "Governance and Adaptation Strategies" in quite some detail. While this is an important topic, it appears that this discussion would fit better in one of the previous chapters targeting adaptation specifically. (Hans-Martin Füssel, European Environment Agency)	Thank you. This section was completely restructured and shortened, in part by now referencing Chapter 16.
523	52788	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. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	Yes this has been addressed also under the issue of institutional vulnerability and governance in 19.6.1.3.3
524	52789	19	50	8	50	8	IRGC (2005) doesn't appear in list of references. (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	This reference was removed.
525	52791	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). (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	The text has been modified and revised heavily.
526	52790	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). (Tim Rayner, University of East Anglia, Tyndall Centre for Climate Change Research)	The section on governance has been modified heavily.
527	54356	19	50	44	50	45	The quantitative basis for this statement implied by the use of "likely" is somewhat unclear. Assigning a level of confidence may be more appropriate in this context. It is also unclear what time horizon is intended or if this is an open-ended statement. (Michael Mastrandrea, IPCC WGII TSU)	The section was completely restructured and this sentence was removed.
528	51118	19	50	47	50	47	The author team might consider use of calibrated uncertainty language per the guidance for authors to characterize this emerging literature and current state of agreement regarding it. (Katharine Mach, IPCC WGII TSU)	This section was completely restructured and this sentence was removed.
529	38942	19	51	28	51	28	Reference Diagne, 2007 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference was removed.
530	49193	19	51	30	51	33	It seem slike "all communities" pointing to indigenous communities, but this is not clear. I think you should add a sentence upfront. (Oyvind Christophersen, Climate and Pollution Agency)	This section was completely restructured and this sentence was removed.
531	38943	19	51	40	51	40	Reference Raleigh, 2010 is not listed in refrences (MUHAMMAD ADNAN, MINISTRY OF CLIMATE CHANGE)	This reference was removed.
532	39971	19	51	49	51	50	move 'effectively' to after 'outputs' to remove split infinitive and improve clarity (Peter Burt, University of Greenwich)	This section was completely restructured and this sentence was removed.
533	41571	19	52	3	0	0	FAQs: The top FAQ should be, I think: What are the (eg) top 5 global risks from CC? Are they regionally focussed, if so where (the hotspots). (Martin Parry, Imperial College)	This is handled in text and we do not think is apprpriate for an FAQ.
534	47006	19	52	3	0	0	The section on Frequently Asked Questions, should be further expanded and should try to cover the core of chapter 19. Especially in regard to the relation of (1) physical impacts, vulnerability and exposure, (2) trends (3) summary of the 'keys (risk/vulnerabilities/impacts)' as well as (4) emergent risks. Currently the FAQ to my opinion does not well reflect the essence of chapter 19. (Stefan Kienberger, University of Salzburg)	FAQs rewritten
535	39502	19	52	5	14	0	The definitions are not consistent with discussions in chapters 1, 2 and to some extent also 5 (coasts, which deals with risk management). The distinction between the hazard and the risk is increasingly expressed in both research and real-world policy and practice, so this aspect needs to be dealt with here. (Sarah Cornell, Stockholm Resilience Centre)	Pagination incorrect

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
536	47005	19	52	11	52	12	The vulnerability definition here should be in line with the one provided in the definition box earlier. Here the term susceptibility is used (which should be defined as well), whereas in the box above vulnerability is referred to propensity/predisposition. Here the terms should be better harmonised and in the same line. In general the impact and its seperation from risk is not clear. Impact as "effect or damage" whereas risk is seen as "probability of a damaging event or series" . For both cost examples monetary values are provided which leads to further confusion. Next to the inconsistency in defining vulnerability, its relation to risk and impacts is not mentioned here and should be further clarified. (Stefan Kienberger, University of Salzburg)	The FAQs have been rewritten
537	39503	19	52	27	0	0	Some of the work on characterising the anthropocene might be relevant in this context. (Sarah Cornell, Stockholm Resilience Centre)	We do not understand the recommendation.
538	39972	19	52	32	52	32	bad English. Don't start sentence with 'But' (Peter Burt, University of Greenwich)	We disagree
539	35100	19	71	43	71	45	This paper is now published and its reference needs to be updated. (Olivier Boucher, LMD/CNRS)	Thank you for noting this.
540	43366	19	79	0	0	0	Table 19-1: The use of "Benefit of mitigation *to/for XYZ*" is confusing because mitigation benefits all climate-sensitive systems and sectors. I suggest rewording, e.g. "Benefits of mtigation to agriculture offset by land use change" in (iii) could be changed to "Emerging risk of food insecurity due to mitigation-driven land-use change. (Hans-Martin Füssel, European Environment Agency)	We reworded all the cells beginning with "Benefits of mitigation..." based on your comments.
541	49195	19	79	0	0	0	The note(i) under Table 19-1 contains a text with interesting figures which are however hard to compare and see in a context; "First-generation biofuel consumption has been projected to increase by up to 170-220% by 2020 and up to 250-620% by 2030 (IEA, 2009), with the larger numbers corresponding to the implementation of a limit of 450ppm for CO2 concentrations. Second generation biofuels are thought not to be commercially viable for large scale production until after 2020. Biofuels presently occupy about 2.2% of global cropland, whilst the area under cultivation itself is expanding at some 3.4 million ha/yr (FAO 2010) due to rising demand for food. Hence, such large projections for increase in biofuel production have profound implications for land use. If this biofuel induced land use change removes primary forest, the net contribution of the biofuel cropping towards climate change mitigation may be negative. The potential scope of the impact on a global scale is revealed in one study (Wise et al 2009) which considers a scenario leading to conversion of more than 40% of global land area to biofuel production by 2095." I would suggest to use the same units, e.g km2 and bring in some of the figures from line 7-11 on page 16. As an example follows the table below; Global land area 150 million km2 Agriculture 40 " " Cropland 15 " " Pasture 23- 30 " " Biofuel (2,2 % of Cropland) 0,33 " " Biofuel,annual growth (x%) y Annual cultivation of area for food production 0,034 " " 100 % transition to vegetarian diet will free 28 million km2 10 % transition to vegetarian diet will free 2,8 " " (Oyvind Christophersen, Climate and Pollution Agency)	Based on your suggestions here and in the original section 19.3.2.2.2. clarifications were made in the text for consistency. In note (i) we used ha as a common unit to explain the extent of current biofuel feedstock land as well as the size of the annual expansion. The magnitude of the impacts of a vegetarian diet strategy were moved to what is now section 19.4.1., where we added in a percentage figure to explain the size of the land that could be freed up. However, due to space constraints we could not a more full accounting of the global land base (ag, pasture, etc...). That said, global ag extent could be calculated from the data given if the user chose to.
542	49196	19	79	0	0	0	Global land area 150 million km2 Agriculture 40 Cropland 15 " " Pasture 23- 30 " " Biofuel (2,2 % of Cropland) 0,33 " " Biofuel,annual growth (x%) y Annual cultivation of area for food production 0,034 " " 100 % transition to vegetarian diet will free 28 million km2 10 % transition to vegetarian diet will free 2,8 " " (Oyvind Christophersen, Climate and Pollution Agency)	This appears to be a duplicate of the above comment which has been addressed
543	51119	19	79	0	0	0	Table 19-1. As a minor point, in the 2nd note, if "likely" is being used per the uncertainties guidance for authors (reflecting a probabilistic basis for its assignment), it should be italicized. Casual usage of the reserved likelihood term should be avoided. (Katharine Mach, IPCC WGII TSU)	Changed 'likely' to 'expected' to better reflect intent of original reference and to conform to uncertainty guidelines.
544	54357	19	79	0	0	0	Table 19-1: It would be worth considering whether the extensive notes included with this table might be easier to read as part of the chapter text rather than table footnotes. (Michael Mastrandrea, IPCC WGII TSU)	We have reduced the footnote text to some extent, but found the table and its footnotes a useful space saving device.
545	49194	19	79	0	80	0	Tab 19-1: We propose to underline also in connection with this table possible ways of utilizing biofules that are positive for climate change mitigation. This emergent risk should be included better in the executive summary. (Oyvind Christophersen, Climate and Pollution Agency)	The table is primarily focused on risks of pursuing a biofuel strategy. However, based on your comments we have significantly reorganized the parent section (19.3.2.2.2.), including a more thorough introduction explaining biofuels as a mitigation strategy. Please refer to what is now section 19.3.2.2.
546	43367	19	81	0	0	0	Table 19-3: The order of chapters (13, 19, 23, 26, 4, 6, 22, 24, 25) appears arbitrary and should be changed. Furthermore, a consistent separation between "Physical impacts" and "Key risks" should be chosen (and explained). The qualification as "key risk" could be done, for example, on an anthropocentric perspective (only impacts directly affecting people qualify as "key risks") or on a UNFCCC Art. 2 perspective (also impacts on ecosystems qualify as "key risks" even if they do not directly affect people). In my view, "crop failure" and "increases in crop losses" are "physical impacts" rather than "key risks" as long as they do not affect the livelihoods or food security of people depending on the sale or purchase of those crops. Whether "biome changes" and the "loss of biodiversity" qualify as "key risks" depends on the choice of an anthropocentric or of a wider perspective. (Hans-Martin Füssel, European Environment Agency)	Has been modified - we still discuss whether the grouping of the table should follow chapter numbers or specific larger categories, such as urban - rural, human vulnerability, ecosystem vulnerability etc. Hence the comment is very useful and we also have addressed the consistency issue of some of the input. However, in terms of the content of the table we rely on input of other chapters.
547	51120	19	81	0	0	0	Table 19-3. In further development of this table, the author team should provide cross-references to specific chapter sections containing the traceable accounts in support of examples provided here. Additionally, the author team should ensure meaningful specificity for examples provided--what regions, sectors, etc. are relevant for each example? (Katharine Mach, IPCC WGII TSU)	We appreciate this comment and have included as many lines of site as we were able to acquire from the other chapters for the SOD, but will includes lines of site for all entries in the FGD.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
548	54358	19	81	0	0	0	Table 19-3: This table has the potential to be a very useful synthesis of information. Given its density, clarity in each entry is critical. In this context, I suggest considering a reordering of the columns, as currently the physical impact/hazards column that appears first does not really give a clear sense of the topic discussed in a given row when it is read first. A more logical ordering would be to put "key risks" first, as these are really the topic of each row, followed by "physical impact/hazards" and "key vulnerabilities" (that combine in key risks), and finally "emergent risks." In addition, many of the entries are currently fairly general and would benefit from further specificity, or at least concrete examples of the phenomena described to enhance the utility of the table. It would also be useful to cross-reference the relevant chapter sections where each entry is discussed. Finally, are there no examples of moderate vulnerability interacting with very large physical impact that can be included? (Michael Mastrandrea, IPCC WGII TSU)	The comment is very valuable, however, the idea behind it is to show that physical changes or changes in climate extremes or climate conditions do not necessarily lead to risks, only in combination with key vulnerabilities. Consequently we believe the order of the table is quite logical. We will, however, work to make sure that readers also understand this logic as we further develop the table for the FGD.
549	54359	19	81	0	0	0	Table 19-3 (second row): Is "soaring demand (and prices) of biofuels due to climate change policies" really a physical impact/hazard? Might it be an emergent risk? (Michael Mastrandrea, IPCC WGII TSU)	Yes, but at this stage we mainly summarized the information provided form other chapters. We will have another consultation with other chapters to discuss these points or open isues in depth.
550	37040	19	81	0	83	0	Table 19-3: Please consider shortening this table to one example per chapter. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)	The examples are illustrations of what key risks are and which factors determine these key risks (vulnerability and hazards). The limitation to one example per chapter therefore seems unnecessary.
551	38499	19	81	0	83	0	Would be good to include all chapter headings (only done for first one). (Claire Goodess, University of East Anglia)	Thank you. We included all chapter headings as suggested.
552	49197	19	81	0	83	0	Tab 19-3: We like this table very much, and hope that it will be possible to include som of the consept by examples in the executive summary (Oyvind Christophersen, Climate and Pollution Agency)	We tried to add some points in the excecutive summary, please have a look whether that is sufficient or whether we need more examples based on Table 19-3.
553	52255	19	81	1	83	1	This is a nice and useful table. What is not at all clear is the basis for the ordering of the chapters and points. It would help to perhaps classify the impacts by type or something similar. Only for the first chapter was the title of the chapter even indicated. (Michael MacCracken, Climate Institute)	Thank you. The chapters were reordered. The entries now progress in numerical order.
554	49198	19	84	0	0	0	Tab 19-4: AR4 estimates of SCC should be added (Oyvind Christophersen, Climate and Pollution Agency)	This table has been deleted.
555	54360	19	84	0	0	0	Table 19-4: Please match the papers listed with the estimates, if this is possible to do compactly. (Michael Mastrandrea, IPCC WGII TSU)	This table has been deleted.
556	52137	19	85	0	0	0	Figure 19-1. Given that risks originate from the overlap of vulnerability, exposure, and physical impacts in this figure, does it make sense to have the circles for key vulnerabilities and physical impacts NOT overlap with the other "propeller blades" within this figure? That is for example, should the circle for key vulnerabilities overlap with the large ovals for exposure and physical impacts? (Katharine Mach, IPCC WGII TSU)	This figure has been redone.
557	53973	19	85	0	0	0	Figure 19-1: Ovals with a word “Key” and “emergent” are a little confusing as they are described in this figure. They look separate word/concept from “Physical impact,” “Vulnerability,” or “Risk.” We could further work on developing this conceptual figure at LAM3 if appropriate. (Yuka Estrada, IPCC WGII TSU)	This figure has been redone.
558	43384	19	86	0	0	0	Figure 19.2: An interesting illustration but I think some clarification is needed. Is the change assessed a function of mean temperature rise? Is there a meaning of the grey value of the different cells? (Christian Huggel, University of Zurich)	Figure and caption have been modified for clarity.
559	51121	19	86	0	0	0	Figure 19-2. The author team should cross-reference assessment in chapters 6 and 30 in further development of this figure. (Katharine Mach, IPCC WGII TSU)	Chapter 6 is now cross-referenced.
560	53974	19	86	0	0	0	Figure 19-2: This is an interesting figure to display a complex concept. Since it is set up as a matrix, the gray shade could be removed. Having gray shades in the background makes it difficult to focus on the boxes. If possible, the adding/incorporating additional aspects may provide more insightful information. For instance, could the direction of the impact (negative or positive) be added? One other thing, the likelihood of N-fixation/Nitrification being affected by ocean acidification varies from unlikely to very likely as opposed to that of metal separation which seems pretty narrow. Where is this variation coming from? Can the number of studies be described? (Yuka Estrada, IPCC WGII TSU)	Figure and caption have been modified for clarity.
561	54342	19	86	0	0	0	Figure 19-2: Does this assessment only consider adverse impacts? If so, it would be useful to specify in the figure caption. (Michael Mastrandrea, IPCC WGII TSU)	Figure and caption have been modified for clarity.
562	43368	19	87	0	0	0	Figure 19-3: The caption starts with "Northern Hemisphere" but the map is global. If the authors intend to refer to the JJA period, I suggest to change the title to "Simulated changes in precipitation during boreal summer...". (Hans-Martin Füssel, European Environment Agency)	This figure has been deleted.
563	49199	19	87	0	0	0	Fig 19-3: It is difficult to understand the explanation of hatch marks (Oyvind Christophersen, Climate and Pollution Agency)	This figure has been deleted.
564	53804	19	87	0	0	0	Figure 19-4 is included in several chapters. If not needed here, there could be a reference to chapter 1, for example. (Kristie L. Ebi, IPCC WGII TSU)	This figure has been deleted.
565	53975	19	87	0	0	0	Figure 19-4: It would be helpful for readers to have clarification on axis labels (i.e., how does, or what aspect of, socio-economic challenges for adaptation change along the x-axis?) It also would be helpful to have further elaboration for the labels of each pathway (e.g., (High Challenges) “fragmentation.” Are there any overlaps among different scenarios? Finally this is the same figure used in Figure 20-3, cross-chapter coordination maybe required. (Yuka Estrada, IPCC WGII TSU)	This figure has been deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
566	54344	19	87	0	0	0	Figure 19-3: Which time period of the A1B scenario, and which model(s) were employed (perhaps implying a certain temperature increase)? Please specify. (Michael Mastrandrea, IPCC WGII TSU)	This figure has been deleted.
567	49200	19	88	0	0	0	Fig 19-5: How is global damage defined? What is the unit? This should be included in the cation (Oyvind Christophersen, Climate and Pollution Agency)	Now note that this is a percentage loss of global output.
568	53976	19	88	0	89	0	Figure 19-5 & Figure 19-6: It would be easier for readers to follow the narrative if the color scheme is consistent among figures. (i.e., same color should be used for DICE 2007). (Yuka Estrada, IPCC WGII TSU)	Done.
569	52256	19	88	1	89	1	I just do not see the basis for including these figures, given how inaccurate it is generally agreed their results are. At the very least, choose one or two of the most comprehensive models and show the types of results they seem capable of representing, but there is no basis for including results that are just clearly inadequate, like the FUND study of the Interagency WG (I would note that given all the shortcomings identified in their internal review process, there is no way this would have gotten through a peer review into a journal--at least it should not have without much more open acknowledgement of its shortcomings and the older versions of models that were used in the analysis). (Michael MacCracken, Climate Institute)	The USG analysis used the versions of the models that were current at the time of the analysis (2009). We use the most current available version of the models, and show uncertainty estimates where available.
570	51122	19	89	0	0	0	Figure 19-6. As a minor point, "low agreement," as calibrated uncertainty language, should be italicized. (Katharine Mach, IPCC WGII TSU)	Done.
571	43369	19	90	0	0	0	Figure 19-1: This figure does not appear to be very useful and accessible as it derives from a figure attempting to convey a (semi-)quantitative message (Smith et al. 2001 and 2009) but now focusses on conveying a conceptual message (i.e., impacts risks are determined by climate change and vulnerability). Specifically, the figure selects only 1 out of 5 reasons for concern: aggregate impacts. In this way the very relevant knowledge on the other reasons for concern, and their differential sensitivity to climate change is lost. Furthermore, the choice of "aggregate impacts" appears unfortunate, considering that the discussion in Section 19.6.3.4 focusses on aggregated *monetary* impacts, and the aggregated monetary impacts of climate change are arguably less dependent on the "vulnerability" of a society. In my view, the (socio-economic) vulnerability of a society is a stronger determinant of social and health impacts, and on the distribution of all impacts, than on aggregated (monetary) impacts. Finally, the colour-coding (erroneously?) suggests that the physical risks of climate change are now assessed much lower than in Smith et al. 2009. Whereas the Smith et al. 2009 column suggests that for (implicitly assumed) medium (socio-economic) vulnerability, "red risks" start around 4 °C GMT increase (in the AR4), the area outside that column suggests that even a 5 °C GMT increase combined with medium (socio-economic) vulnerability would lead to "orange risks" only. I cannot find evidence for such a lower, revised assessment of risks in the underlying Section 19.6. I suggest replacing the current Figure 19-7 by an update of the figure from Smith et al. 2009, which in itself was an updated of Smith et al. 2001 (IPCC TAR). The design of this "burning embers diagram" is well established, and the underlying analysis has already been done in Section 19.6. The authors may wish to indicate in such an updated "burnign embers diagram" which of the reasons for concern is particularly sensitive to socio-economic development pathways if they find a way to add this information without squeezing too much information in a single figure. (Hans-Martin Füssel, European Environment Agency)	We have revised this figure to make it completely illustrative, not relating to any given RFC, while at the same time introducing a new figure that updates the TAR/Smith et al. burning embers figure. We hope that the combination of the two, one specific and quantitative, and the other illustrative, is now a clearer and more complete treatment of the RFCs.
572	43385	19	90	0	0	0	Figure 19.7: see my comments made above. (Christian Huggel, University of Zurich)	This figure (now Figure 19-6) and its caption have been modified for clarity.
573	49201	19	90	0	0	0	Fig 19-8: Acidification is pointed out as one impact with a relative quick response to mitigation, We peopose to include ocean adidification in the figure. (Oyvind Christophersen, Climate and Pollution Agency)	Thankyou for this useful suggestion which we were unable to take forward for the SOD but plan to do for the FGD.