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|---|-------|----|-----------|-----------|---------|---------|--|--|
| 1 | 58087 | 10 | 0         | 0         | 0       | 0       | General: There is very little reference to the impacts of climate change on micro and small business. They are only mentioned on the insurances section. Insurances are not a feasible adaptation option for these businesses; perhaps as a first response to an event, but not for areas that might be more frequently flooded or affected by droughts, or perhaps by other changes that are not necessarily disasters and hence is difficult to define the insurance. It is also not financially sustainable for insurance companies. There are examples of insurance companies that have gone bankrupt when offering insurances to droughts or to other climate related events. If a business is frequently flooded for example it will get to the point that the option will be to move somewhere else and not to depend on insurances for example. (Carmen Lacambra Segura, Grupo La era) | Given that insurance is offered in a country, this type of risk sharing arrangement belongs to the adaptation options available to small enterprises. It is not disputed that there might emerge limits of insurability determined by the need to balance loss frequency / intensity, associated risk-based capital costs and its availability, administrative costs, and affordability of the premiums. |
| 2 | 58159 | 10 | 0         | 0         | 0       | 0       | General Comments on Chapter 10. Key Economic Sectors and Services: This chapter presents the key economic sectors as energy, water, transport, other primary & secondary economic activities, recreation & tourism, insurance, health, impacts on markets & development and research needs & priorities. The impressive parts in this chapter are the tables as Table 10-1 Main projected impacts of climate change & extreme weather events (EWEs) on energy supply. Also, the effects on pipelines & the electricity grid (Table 10-2). (Mounir Wahba Labib, Third National Communication (TNC) Project)   | thank you  |
| 3 | 59451 | 10 | 0         | 0         | 0       | 0       | Interesting chapter but needing a more homogeneous structure. Similarly to to section 10.2.1. all other sectors should present separately expected physical impact and conclude with macroeconomic impact. This is particularly true for section 10.3 water. (Danae Diakoulaki, Chemical Engineering, NTUA, Greece) (GREECE)   | organization is around economic sectors, each with their specific issues, and depends on coverage in other chapters  |
| 4 | 59452 | 10 | 0         | 0         | 0       | 0       | Use same terminology throughout the chapter. Macroeconomic impact, economic losses, economic impact, market impact are all used in different sections to describe economic implications of climate change on the examined key sectors. (Danae Diakoulaki, Chemical Engineering, NTUA, Greece) (GREECE)   | Chapter has been revised to assure consistency.  |
| 5 | 59453 | 10 | 0         | 0         | 0       | 0       | Combined heat and power is not referenced in the chapter. (Costas Balaras, Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Greece) (GREECE)  | Impacts same as thermal; mentioned in the text.  |
| 6 | 59454 | 10 | 0         | 0         | 0       | 0       | As a general comment the chapter is well written and edited. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)   | thank you  |
| 7 | 60007 | 10 | 0         | 0         | 0       | 0       | General comment - Suggest that 'climate change' should not be abbreviated to 'CC' as is done throughout the chapter. (AUSTRALIA)   | Keep CC and EWEs to make the text flow better. Final decision left to copy editor.   |
| 8 | 61222 | 10 | 0         | 0         | 0       | 0       | This chapter lacks a discussion on the employment impacts of climate change and climate change adaptation. It would also be useful to introduce some elements on the sectors to be positively affected by adaptation investments and measures. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | Employment impacts are beyond the scope in 10.2. Impacts on employment are indirectly included in the economy-wide impacts.  |
| 9 | 61223 | 10 | 0         | 0         | 0       | 0       | This chapter is very well organised and written and fulfils the purpose of IPCC by bringing together wide range of available literature of climate change impacts on key economic sectors and services by highlighting the uncertainties. It also points out that more research needs to be done as many economic sectors are not covered sufficiently. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | Thank you.   |

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| 10 | 61224 | 10 | 0         | 0         | 0       | 0       | Taking the list of economic activities (ISIC) and use it in the scopus literature search for CC impacts the discussion in the chapter is acceptable. The executive summary is a bit typical, because it comes with vague statements, like ....does not include any quantitative assessments, ...even no rankings (like e.g. climate change impact large/small etc.), ....typical quantitative descriptions of mechanisms are given, but no spatial/functional overview on the explicit outcomes. Instead statements like, ....varies across regions, ....CC would affect different energy sources differently, ....heterogeneous in both sign and size. The reason for this situation is from my point of view that most of literature quoted is on single case studies only (possibly state of the art). The authors recognise that cases are different, but have no idea what the relevant boundary conditions are to order (and thereby to generalise) the cases (e.g. what is the trade-off between increasing cooling and decreasing heating energy demand, although literature for certain regions is available, cf. Olonscheck et al. 2011, Energy Policy). Consequently the authors cannot provide valid and relevant statements for regions, nations, the world. This is needed for a quantitative impact assessment: the most important pending question for this chapter is: how to abstract from cases, which regions are similar, by which conditions is this determined. The "research needs" section (10.10) does not reflect this basic problem at all. What they do instead is counting articles ("little literature exists on") for the different sectors and conclude "here has to be done more in future". No structural approach aiming at full spatial coverage and comprehensive understanding. But maybe this is not their task and reflects the bulk of existing literature; nevertheless a synthesis for this literature can be expected. To summarize: the authors say: under CC this and that can happen to the different economic activities (we have respective case studies) - and that is why CC may be dangerous. That looks a bit poor to our view, although they were diligent. We recognise however the difficulty to draw more general statements out of this material. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit) | This chapter assesses global literature on key economic sectors and services, as requested by the IPCC. Regional literature and some economic impacts are covered elsewhere in the report. The TS and SPM pull together summary statements across the different chapters and for specific regions. The revised Exec Summ of Chapter 10 reflects the author team's key messages regarding potential impact of climate change on the key economic sectors and services. |
| 11 | 63559 | 10 | 0         | 0         | 0       | 0       | The whole chapter has a strong focus on market based instruments. It is common sense in economics that public and common goods, e.g. climate impacts and adaptation measures, can't be managed by market based instruments alone. The chapter should discuss also possible market failures, the market design and the possible need for public interventions. (GERMANY)  | Public intervention, for instance, is discussed in 10.7.6.; market failure plays a role in 10.7.4.2 and 10.7.5.1. Other elements of this comment are covered in chapter 17, and then addressed in the TS and SPM for all chapters.  |
| 12 | 72999 | 10 | 0         | 0         | 0       | 0       | Are the dollar figures reported for damages - for example in the energy and water sections - in real or nominal terms? Are they directly comparable across studies? (UNITED STATES OF AMERICA)   | Monetary estimates have been made consistent throughout the chapter.  |
| 13 | 73000 | 10 | 0         | 0         | 0       | 0       | As a whole, this chapter is fairly well written and organized compared to other chapters. Another resource that may prove useful with regard to studies by sector - though its focus is on studies that quantify the costs and benefits of adaptation - is Agrawala et al. (2011) IRERE. (UNITED STATES OF AMERICA)  | Chapter 17 covers economics of adaptation. And reference was provided to that team.   |
| 14 | 73001 | 10 | 0         | 0         | 0       | 0       | At times, the text makes general statements that readers may infer apply to all or most countries. But in some instances, there are significant differences in impacts between developed and developing countries. Suggest clarifying when statements apply to a subgroup of countries or apply globally. e.g., Sec 10.4.1 on Roads makes no geographic references; if the statements in the section are applicable to all countries (or some subgroup), the text should make this clear. (UNITED STATES OF AMERICA)   | we agree with the statement and have attempted to address where applicable. This chapter assesses global literature on key economic sectors and services, as requested by the IPCC. Regional literature and some economic impacts are covered elsewhere in the report. The TS and SPM pull together summary statements across the different chapters and for specific region  |

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| 15 | 73002 | 10 | 0         | 0         | 0       | 0       | Conceptually, the impacts of climate change on infrastructure generally, including water, electricity, and transportation can be conceptualized as follows: Infrastructure is designed to operate successfully under anticipated environmental conditions. If actual conditions fall outside the design range, due to climate change or any other reason, operations may be impaired and/or the asset may be damaged or destroyed. Thus, changing conditions increase risk of impairment or failure. Greater variability of anticipated climatic conditions makes ex ante risk of failure greater for a given design. Designers and operators may choose to bear this additional risk or compensate through changes in designs or operating conditions. Greater uncertainty about climatic conditions makes it harder to identify ex ante risks, and may discourage building long-lived or highly optimized systems. While any particular asset may face greater ex ante risks as a result of climate change, viewed from a system perspective, and the aggregation of increased risks to particular assets over time implies an ex ante loss of capacity and reliability for the system as a whole. If the existence of an increased climate risk is observed by system operators, they may choose to either bear the added risk or mitigate the risk (at some cost) through hardening, redundancy, and provision for rapid recovery. Thinking about climate impacts in this way allows provides a possible approach to estimating the costs of a rather intricate set of physical impacts of climate change on disparate infrastructure systems, as well as the basis for a discussion about how addressing these physical impacts will provide expected benefits in the form of restored reliability and capacity. (UNITED STATES OF AMERICA) | We agree with the comment. Section 10.9 additions address aggregate economic impacts and language has been added to convey the aggregate risks. |
| 16 | 73003 | 10 | 0         | 0         | 0       | 0       | Discussion of economic value of ecosystem services in this chapter and other chapters should include discussion of this model: <a href="http://www.naturalcapitalproject.org/InVEST.html">http://www.naturalcapitalproject.org/InVEST.html</a> . InVEST enables decision-makers to assess the tradeoffs associated with alternative choices and to identify areas where investment in natural capital can enhance human development and conservation in terrestrial, freshwater, and marine ecosystems. Questions InVEST can answer: How will a new coastal management plan impact seafood harvest, renewable energy production, and protection from storms? Where would reforestation or protection achieve the greatest downstream water quality benefits? Which parts of a watershed provide the greatest carbon sequestration, biodiversity, and tourism values? (UNITED STATES OF AMERICA)  | Comment appropriate for Chapter 17 and has been referred.   |
| 17 | 73004 | 10 | 0         | 0         | 0       | 0       | Tables 10-1, 10-2, and 10-3 are very useful. Would like to see similar tables for other sectors if possible. (UNITED STATES OF AMERICA)  | Space constraints limited additional tables.  |
| 18 | 73005 | 10 | 0         | 0         | 0       | 0       | There are some duplicate citations. This occurs several times throughout the chapter. Some citations are not in the reference list. Will the 2013 references be available by the time the document is made public? (UNITED STATES OF AMERICA)  | references have been revised and corrected for duplicates, missing items, etc.  |
| 19 | 73006 | 10 | 0         | 0         | 0       | 0       | What about pre-existing subsidies, for example in energy supply, that may distort signals with regard to climate adaptation? A possible policy outcome might be to remove those subsidies that send signals counter to what we want to get people to account for climate change in decision making. If a literature exists on the impact of the removal of such subsidies, please add. (UNITED STATES OF AMERICA)  | Accepted, mentioned in 10.2. Detailed discussion in the Adaptation chapters.  |
| 20 | 73007 | 10 | 0         | 0         | 0       | 0       | While the chapter notes that welfare changes are discussed in a separate chapter, it does seem worth reminding the reader of what GDP can and cannot capture as a measure of impacts. (It is not a welfare measure.) (UNITED STATES OF AMERICA)  | Noted. Space limits ability to address in detail.   |
| 21 | 77188 | 10 | 0         | 0         | 0       | 0       | The structure of the chapter deals with the complexity of the GCC dissecting the effect on different sectors and introducing systems for the description of systemic effects, such as sectoral interdependencies within each description. In reading overall effects on individual systems and infrastructure appear to be well focused and described, while the effects resulting from interdependencies between systems are less clear. Perhaps the argument can become part of a cross-chapter box. (ITALY)   | 10.9 addresses aggregate impacts.   |
| 22 | 77570 | 10 | 0         | 0         | 0       | 0       | This chapter requires another round of editing for grammar and continuity. Please provide regions where this poverty trap might occur? Please refer Duflo-Banerjee papers in this topic (Malini Nair, Indian Institute of Science)   | thank you. Chapter has been revised.  |
| 23 | 78184 | 10 | 0         | 0         | 0       | 0       | The contribution to the SPM could add a summary for transport,transmission of energy, roads, shipping (Christiano de Campos, Petroleo Brasileiro SA)   | Transmission of energy (pipelines, grid) already included inchapter ES in SOD. SPM is WG-level decision.  |
| 24 | 79526 | 10 | 0         | 0         | 0       | 0       | A general comment on the chapter is that it feel imbalanced, given the space given to the tourism sector vs some of the earlier sectors which are arguably more important economically (transport, water). (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | Chapter coverage reflects the literature.   |
| 25 | 79527 | 10 | 0         | 0         | 0       | 0       | there is a large focus on tourism and impacts on ski resorts, which seems disproportionate to some other sections (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)   | Chapter coverage reflects the literature.   |

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| 26 | 79528 | 10 | 0         | 0         | 0       | 0       | The exec summary does not give any indication of what the section is about, instead it just launches straight into findings. Suggest a one line stating purpose of the chapter forms part of exec summary. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | Text added.   |
| 27 | 81038 | 10 | 0         | 0         | 0       | 0       | There are some missing/ incorrect citations in the chapter. These discrepancies have been highlighted in the ref check document for chapter 10 and is available in the supporting material web page. Chapter team may wish to rectify these errors before starting to work on SOD revisions and FGD preparation. (Monalisa Chatterjee, IPCC WGII TSU)  | references have been revised and corrected for duplicates, missing items, etc.  |
| 28 | 82410 | 10 | 0         | 0         | 0       | 0       | 1) Overall -- The chapter team has developed a robust second-order draft. In the final draft, the chapter team is encouraged to continue its prioritization of compact and rigorous assessment, effective tables, and high specificity. Additionally, condensing and tightening each section as much as possible should be a priority. (Katharine Mach, IPCC WGII TSU)   | Chapter has been revised.   |
| 29 | 82411 | 10 | 0         | 0         | 0       | 0       | 2) Coordination across Working Group II -- In developing the final draft of the chapter, the author team should continue to ensure coordinated assessment, both in the chapter text and at the level of key findings. As appropriate, cross-references to the sections of other chapters and/or their assessment findings should be used, continuing to ensure that overlaps are reduced and assessment harmonized. (Katharine Mach, IPCC WGII TSU)  | Cross-referencing has been initiated. For instance, 10.7 as the focal point for discussion of insurance is cross referenced in chapters 13, 17, 18.           |
| 30 | 82412 | 10 | 0         | 0         | 0       | 0       | 3) Harmonization with the Working Group I contribution to the AR5 -- In developing the final draft, the chapter team should also ensure all cross-references to the Working Group I contribution are updated, with discussion of climate, climate change, and climate extremes referencing the assessment findings in that volume. (Katharine Mach, IPCC WGII TSU)   | Correct. WG1-references have been thoroughly updated and looked through, including some adjustments to better adjust 10.7.3 text passages to findings of WG1. |
| 31 | 82413 | 10 | 0         | 0         | 0       | 0       | 4) Report release -- The chapter team should be aware that the final drafts of the chapters will be posted publicly at the time of the SPM approval, before final copyediting has occurred. Thus, the chapter team is encouraged to continue its careful attention to refined syntax and perfected referencing. (Katharine Mach, IPCC WGII TSU)  | Noted. Chapter has been revised   |
| 32 | 82414 | 10 | 0         | 0         | 0       | 0       | 5) Characterization of future risks -- In characterizing future risks related to key economic sectors and services, to the degree appropriate the chapter team should indicate the extent to which risks (or key risks) can be reduced through mitigation, adaptation, development, poverty reduction, etc. That is, is it possible to indicate how risks may increase as the level of climate change increases or, potentially, to indicate the relative importance of changes in mean conditions, as compared to changes in extreme events, as compared to potential non-linear changes associated with biome shifts or tipping points? And then, how much can these risks be reduced through adaptation or development, in the near-term and long-term? How are factors or stressors that multiply risks relevant in this context? As supported by its assessment of the literature, the author team should consider communicating risks for the era of climate responsibility (the next few decades, for which projected temperatures do not vary substantially across socioeconomic/climate scenarios) and for the era of climate options (the 2nd half of the 21st century and beyond). As might be helpful to the chapter, the framing of table SPM.4 could be considered in characterization of future risks, along with the key and emergent risk typology of chapter 19. (Katharine Mach, IPCC WGII TSU) | Noted. Chapter has been revised   |
| 33 | 82415 | 10 | 0         | 0         | 0       | 0       | 6) Informing the summary products -- To support robust and insightful summary products for the report, the chapter team is encouraged to maximize nuance and traceability in its key findings, also continuing its use of calibrated uncertainty language. In addition to nuanced characterization of future risks (see the previous comment), the chapter team is encouraged to consider assessment findings relevant to themes emerging across chapters, indicating for example how extreme events have demonstrated adaptation deficits and vulnerabilities to date and may relate to future risks, how limits to adaptation may be relevant in the context of this chapter, how adaptation experience has been relevant to date, and how interactions among mitigation, adaptation, and sustainable development may occur. (Katharine Mach, IPCC WGII TSU)   | Noted. Chapter has been revised   |

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| 34 | 84600 | 10 | 0         | 0         | 0       | 0       | GENERAL COMMENTS: I congratulate the author team for a well-written and informative SOD. Please see my detailed comments for suggestions related to specificity of ES findings, refining figures and tables, calibrated uncertainty language, and various specific clarifications. I have three general comments. (1) The use of "would" in the executive summary and elsewhere in the chapter text makes the associated statements very ambiguous. Further specificity is needed in each case. Climate change is already occurring, so in each instance it is critical to differentiate impacts that have already been observed from impacts that are expected based on identified sensitivities/vulnerabilities to climate conditions, from specific projections of future impacts. To the extent possible as supported by the literature, it would be useful to characterize impacts that are projected over different time horizons (e.g., mid-century vs. end-of-century). Further, what specific aspects of climate change are relevant in each case? (2) The executive summary uses primarily qualitative agreement/evidence statements, while a variety of quantitative likelihood statements appear in the chapter text. It would be very useful to harmonize the usage of calibrated language across the ES and the text and provide explicit linkages for traceability. Likelihood statements are appropriate where specific quantitative evidence is available. Otherwise, qualitative agreement/evidence or confidence are appropriate. (3) The chapter has a rich set of tables, but only one figure. Please consider other opportunities for figures to support the chapter assessment, if suggested by reviewer comments. (Michael Mastrandrea, IPCC WGII TSU) | ES has been revised. Input provided to TS and SPM in coordination with TSU. |
| 35 | 84601 | 10 | 0         | 0         | 0       | 0       | SUMMARY PRODUCTS: In preparing the final draft of your chapter and particularly your executive summary, please consider the ways in which your chapter material has been incorporated into the draft SPM and TS. For chapter 10, this includes presentation of observed impacts and vulnerabilities in section A.i, principles for effective adaptation in section B.ii, and sectoral risks in section C.i. Are there opportunities for presenting chapter findings and material in a way that further supports broad themes highlighted in the summary products and that facilitates additional cross-chapter synthesis in specific findings or figures/tables? Do the existing summary product drafts suggest additional coordination that should occur between Chapter 10 and other chapters at LAM4? (Michael Mastrandrea, IPCC WGII TSU)  | Noted. Chapter has been revised   |
| 36 | 85210 | 10 | 0         | 0         | 0       | 0       | Totally oblivious to the fact that the earth is not currently warming for the past 15 years, so most of the confident conclusions melt way (Vincent Gray, Climate Consultant)  | impacts are conditional on climate change                                   |
| 37 | 78902 | 10 | 3         | 1         | 0       | 0       | I don't understand the wording "climate change WOULD..." in the executive summary. It makes it sound as if the authors are not sure whether climate change actually is or will be occurring. I think "will" is actually appropriate and defensible in most paras in the executive summary, given the careful phrasing and use of uncertainty/confidence qualifiers to describe the impacts. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)  | Changed to 'will'.  |
| 38 | 82416 | 10 | 3         | 1         | 0       | 0       | Executive Summary. Use of "would" in the key findings of the executive summary is ambiguous. It implies that climate change is a hypothetical, whereas in reality some climate change has already occurred, some is locked in, and some is contingent on development patterns and mitigation choices. Further clarity in describing observed impacts, sensitivities, and vulnerabilities and future risks is encouraged. Please see my overall comment on the chapter on the topic of characterizing future risks. (Katharine Mach, IPCC WGII TSU)   | ES has been revised.  |
| 39 | 73008 | 10 | 3         | 1         | 4       | 24      | Any statements made in the executive summary should be well supported - with citations - in the detailed sections of the chapter. (UNITED STATES OF AMERICA)   | sector linkages are provided in ES.   |
| 40 | 63560 | 10 | 3         | 3         | 3       | 5       | Ch. 10.2.5. summarizes that "climate change per se will likely increase the demand for energy in most regions of the world". This is an important result and should be considered in the executive summary of ch. 10 as well. Suggestion: Add P2 L5: ".. technological conditions. But climate change per se will likely increase the demand for energy in most regions of the world. Increasing income ..." (GERMANY)   | Thank you. ES key message reflects comment.                                 |
| 41 | 84602 | 10 | 3         | 10        | 3       | 11      | Can more detail be provided? What is known about the relative importance in specific regions? What is known about how demand will evolve over time as climate change also evolves? To the extent supported by the literature, further specifics about potential future pathways would aid understanding of the general points being made here. The first paragraph of 10.2.5 provides relevant material (p. 11, l. 18-24). (Michael Mastrandrea, IPCC WGII TSU)  | space limits ability to address in more detail.                             |

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| 42 | 80199 | 10 | 3         | 10        | 4       | 17      | Chapter 10 executive summary (general comment) should note that there are other values other than markets--that is so for both the economic system (some goods and services which are not traded but play a key role in economies), and also for the social systems upon which those economies function. I find that section 10.9 should especially make this point in the executive summary. The claim that there is high agreement that markets "provide an additional mechanism for adaptation and would thus reduce negative impacts and increase positive ones for any specific sector or country (high agreement....)" could be contested on a few grounds--market economies operate on principles of efficiency, and these principles tend to reduce redundancy in systems. Yet these redundancies are actually quite useful and necessary in managing risks--that is a major point in the SREX and throughout AR5 WG2. So this point in the executive summary either needs rewording, more nuance, or some more careful consideration. the chapter on food production points out how closely linked world food markets are, and that disruptions in one market (like the US grain production in 2011) can quickly translate into disruptions in other food markets -- that does not seem in harmony with the claim of the executive summary chapter 10 (point 10.9, lines 10-13). The "high agreement" about markets may come more from a widespread embracing of markets as an ideal--but whether these systems operate on principles that help societies manage and adapt to climate risks needs careful examination--again, principles like redundancy, bolstering resilience at levels more than the macro-level (that is where national governments have to be concerned with adaptation in most cases), distribution of goods and services in ways that bolsters societal resilience, etc. Market mechanisms should be examined against criteria of "what makes successful adaptation"--these are discussed in many of the chapters like 14, 16, 19--and then weigh in on whether there is really evidence based on these criteria to support the claim that markets provide an additional mechanism for adaptation. (Koko Warner, United Nations University - Institute for Environment and Human Security) | Non-market values in Chapter 19. Imperfect markets in Chapter 17. Change "markets" to "well-functioning markets" |
| 43 | 61226 | 10 | 3         | 13        | 3       | 15      | The absence of consideration of the impacts of climate change on biomass in the Executive Summary seems a bit surprising. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | Biomass is addressed in other chapters in detail: food & forestry chapters.                                      |
| 44 | 73009 | 10 | 3         | 17        | 3       | 19      | Please add that there are several options to cope with reduced water availability but at higher cost. This would be a more complete summary of the statement made later in the text. (UNITED STATES OF AMERICA)  | text added.  |
| 45 | 84603 | 10 | 3         | 17        | 3       | 19      | The corresponding chapter section (10.2.2) also mentions decreased efficiency of thermal conversion as a primary concern, but this is not mentioned here in the ES. (Michael Mastrandrea, IPCC WGII TSU)   | Text added.  |
| 46 | 84604 | 10 | 3         | 18        | 3       | 21      | The corresponding chapter section (10.2.2) has a different tone, talking about increased costs associated with some of these options, as well as more limited options for existing plants. The characterization here does not provide a sense of such costs or constraints. (Michael Mastrandrea, IPCC WGII TSU)   | 10.2.2 has many examples, but estimates are too diverse to support a quantified summary statement                |
| 47 | 73010 | 10 | 3         | 23        | 0       | 0       | Change "would" to "may" since according to the text, CC is "about as likely as not" to require.... (UNITED STATES OF AMERICA)  | ES has been revised.   |
| 48 | 65913 | 10 | 3         | 23        | 3       | 29      | Please add: (1) Adaptation of electricity grids might require the adjustment of technical standards and grid regulation. (2) Adaptation costs are likely to be low if an appropriate timing within re-investment cycles is adopted. (References: e.g. Hallegatte, S. (2009) Strategies to adapt to an uncertain climate change, Global Environmental Change, 19, 240-247. Fankhauser & Soare (2013) An economic approach to adaptation: illustrations from Europe, Climatic Change, 118, 367-379.) (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Text Revised   |
| 49 | 79064 | 10 | 3         | 23        | 3       | 42      | Please include a short explanation why pipelines and electricity grids should not be affected in a way and magnitude like (other) transport infrastructure? This needs a clarification. (Joachim Rock, Johann Heinrich von Thuenen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries)  | Text Revised   |
| 50 | 84605 | 10 | 3         | 25        | 3       | 27      | Section 10.2.3 say "may" rather than "about as likely as not," and it does not appear that this assignment is based on specific quantitative evidence. Suggest rephrasing. Is the message that the alternative is no adjustment at all, or that adjustments are still within the range of what is already used in a current area? Does/how does this change over different time horizons? (Michael Mastrandrea, IPCC WGII TSU)   | Text Revised   |

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| 51 | 69073 | 10 | 3         | 25        | 3       | 29      | There is insufficient evidence in 10.2 to support the claim that "Climate change is about as likely as not..." Evidence in 10.2 points to several areas where pipelines and grids are vulnerable, but does not indicate anything about the likelihood. If this assertion is based on expert judgment, the reasoning should be more transparent. (NETHERLANDS)   | ES changed   |
| 52 | 63561 | 10 | 3         | 26        | 0       | 0       | The statement "as likely as" is not useful/applicable. The finding is based on an average view. Chap.10.2 tells there certain regions require adaptation measures e.g. in permafrost areas. Please incorporate this statement in the paragraph (GERMANY)  | ES changed   |
| 53 | 73011 | 10 | 3         | 26        | 3       | 28      | "About as likely as not" does not appear to be supported by the main text in 10.2 or the executive summary. Also, it is confusing to say that "climate change is as likely as not to require the adoption of technological solutions." It would be helpful to tie this back to the IPCC category (remind readers that this is 33 - 66% probability of occurring) and then ensure that the text demonstrates/explains why this is the case. (UNITED STATES OF AMERICA)   | ES changed   |
| 54 | 73012 | 10 | 3         | 31        | 0       | 0       | Replace "heterogeneous in sign and size" with "positive and negative and varying in scale and intensity". (UNITED STATES OF AMERICA)  | Text Revised   |
| 55 | 69074 | 10 | 3         | 31        | 3       | 32      | Not sure what is meant by 'heterogenous in both sign and size'. Is sign the direction of change, i.e. positive of negative? If so is it ethical to attribute these descriptors to change since CC is likely to affect sectors differently? (NETHERLANDS)  | Text Revised   |
| 56 | 84606 | 10 | 3         | 31        | 3       | 34      | More specifics about economic implications are given in the chapter text. Can anything further be concluded based on available evidence? (Michael Mastrandrea, IPCC WGII TSU)   | language reflects author team assessment.  |
| 57 | 57616 | 10 | 3         | 31        | 3       | 36      | In line32, the description "but the economic implications are not well understood" is not suitable. Although the impacts are different from regions, globally the impacts are negtive.It is better to change "but the economic implications are not well understood" to "globally the overall impacts of climate change on water resources, and through these on socio-economic system are negative (medium confidence)" Reference : (1) IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp; (2) Wu Shaohong, Yin Yunhe. Impacts of Climate Extremes on Human Systems. Advances in Climate Change Research. 2012,8,99-102 (In Chinese) (3) Claudia Sadoff and Mike Muller.2009. Water Management, Water Security and Climate Change Adaptation: Early Impacts and Essential Responses. the Global Water Partnership. 85pp. (Cao Jianting, GIWP, Ministry of Water Resources, China) | The author team does not feel that literature support the contention of this comment and will make no changes              |
| 58 | 63562 | 10 | 3         | 31        | 3       | 36      | Key message from the summary of chap. 10.3 is missing. Chapter 10.3.10 states that compared to the expected costs (damages) the costs of adaptation "remain relatively modest". Vote: Replace sentence Line 33ff with key sentence from 10.3.10 (Page 14, L46-L48): "Flooding and drought can ... remain relatively modest". (GERMANY)  | The author team prefers to avoid qualifying statements relative to economic impact such as "modest".                       |
| 59 | 61227 | 10 | 3         | 32        | 3       | 32      | The statement that the economic implications of climate change on water are not well understood does not seem well substantiated. There are estimates of the economic costs of flooding, as well as interesting approaches on assessing competition for water resources and their economic implications. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | The finding is specific to water infrastructure and demand, not flooding, and the reports published are not comprehensive. |
| 60 | 73013 | 10 | 3         | 36        | 3       | 0       | The phrase "water assumed to be available is not" is poorly written. It is suggested you replace it with "water is not available in sufficient quantity or quality for some uses or locations." Also, note the importance of whether water is priced to reflect its true scarcity and user fees are collected for water availability. (UNITED STATES OF AMERICA)  | Text revised   |
| 61 | 77171 | 10 | 3         | 38        | 0       | 40      | suggestion for ending the sentence: "would happen more frequently due to climate change" (ITALY)  | Text revised   |
| 62 | 84607 | 10 | 3         | 38        | 3       | 40      | As with my general comment on the use of "would," "should" here in line 39 is confusing, as climate is changing. Have conditions outside the design range been observed more frequently to date? Is this projected for the future? Is this relevant for specific regions more than others? (Michael Mastrandrea, IPCC WGII TSU)   | ES revised   |
| 63 | 65914 | 10 | 3         | 38        | 3       | 42      | Please add: (1) Adaptation of transport infrastructure might require the adjustment of technical standards, spatial planning and partially utilities regulation. (2) Adaptation costs are likely to be low if an appropriate timing within re-investment cycles is adopted. (References: e.g. Hallegatte, S. (2009) Strategies to adapt to an uncertain climate change, Global Environmental Change, 19, 240-247. Fankhauser & Soare (2013) An economic approach to adaptation: illustrations from Europe, Climatic Change, 118, 367-379.) (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | This is not material for the ES and is addressed on the Section 10.4   |

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| 64 | 73014 | 10 | 3         | 38        | 3       | 42      | What about bridges? This section would be improved by their inclusion. (UNITED STATES OF AMERICA)   | Text added.  |
| 65 | 73015 | 10 | 3         | 39        | 3       | 40      | Regarding "should climate change," climate change has already begun. The following sounds more accurate: "As climate continues to change." (UNITED STATES OF AMERICA)   | ES revised   |
| 66 | 73016 | 10 | 3         | 41        | 3       | 42      | Are there technological solutions available to deal with vulnerable infrastructure built on ice or permafrost? (UNITED STATES OF AMERICA)   | The bullet does not address adaptations only vulnerabilities, Material on adaptation are addressed on the Section 10.4   |
| 67 | 73017 | 10 | 3         | 44        | 3       | 49      | This summary bullet speaks mainly to the substitution effect, but it would also make sense to say something about the income effect on tourism. (UNITED STATES OF AMERICA)  | included in new table 10.10  |
| 68 | 73018 | 10 | 3         | 47        | 3       | 48      | It's not clear that the conclusion of overall "gains for countries closer to the poles and higher up the mountains" is supported by the studies reviewed in this chapter. E.g., Steiger (2010) finds that gains in summer are not expected to outweigh losses in winter (see p. 21). Please either provide a clearer discussion in the text (perhaps at the end of the ski industry paragraphs) of why taken overall the summer gains are expected to dominate in higher latitudes and in the mountains, or rephrase the statement in the executive summary. (UNITED STATES OF AMERICA) | Clarified: Winter tourism is small part of total tourism.  |
| 69 | 73019 | 10 | 3         | 48        | 3       | 0       | After "countries" add "areas within countries." (UNITED STATES OF AMERICA)  | This chapter addresses global issues, and we leave subnational details to the regional chapters.   |
| 70 | 69075 | 10 | 3         | 54        | 3       | 54      | According to 10.7, economic vulnerability reduction through insurance has indeed proven effective, but not always. It would be more accurate to add "under certain circumstances" to the end of this sentence. (NETHERLANDS)  | Wording has not been modified for the reason explained in the following. Melecky and Raddatz, 2011, a recent investigation on macroeconomic effects/benefits that existing natural catastrophe insurance supply has for societies, found that countries with relatively low insurance penetration suffer more in the years following climate disasters than countries with high insurance penetration. For the latter, government expenditures, revenues and output (GDP) increase after catastrophes, while sovereign deficit shows only little change. Different to this, countries with low insurance penetration show a clear increase in government deficit, while output does not change much and government revenues are much less increasing. The interpretation is that high-insurance-countries "can quickly allocate resources from existing insurances to recover productive capacity and little fiscal effort is required to dampen the macro consequences of these events." (p. 26). This is in substantial contrast to countries with low insurance penetration. Similar findings report von Peter, G., S. von Dahlen, and S. Saxena, 2012. As such evidence has been gained by analysing data from a group of many countries, it is justified to infer a general statement for the Executive Summary that insurance grosso modo has been proven to reduce economic vulnerability. The references have been included since SOD. |



| #  | ID    | Ch | From Page | From Line | To Page | To Line | Comment  | Response  |
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| 71 | 73020 | 10 | 4         | 2         | 0       | 0       | The problems with government insurance programs should be recognized in this discussion. They 1) often under-price below actuarial risk, subsidizing increased development and causing potential losses to grow; or 2) are undercut by government bailouts of uninsured losses. (UNITED STATES OF AMERICA)   | As line 2 on page 4 is about "ensuring financially resilient insurance systems" -- indicating stark contrast to government insurance programs such as the loss-making NFIP in the USA -- the comment's recommendation is straightforward: the discussion on insurance has to include problems with government insurance programs. However, the problems listed by the comment, i.e. underpricing or charity hazard, are by no means limited to public programs. The problems with NFIP, as an example, are discussed in 10.7.4.1 and Table 10-6, including also the discussion of underpricing. Charity hazard, i.e. bailing out of the uninsured by the government and thereby undermining the insurance market, is touched in 10.7.6., but from a demand side perspective also in chapter 17.5.1. |
| 72 | 63563 | 10 | 4         | 4         | 4       | 4       | This chapter should additionally consider overall climate change impacts on the entire financial sector (not limited to the insurance sector). First of all, the insurance sector is part of the financial sector and linked to other segments in the financial sector. If the insurance sector has to cover a large amount of losses (caused e. g. by an increase of weather related disasters) this could also have effects on the finance sector. Moreover, not all losses will be insured. This loss of value of private assets can additionally affect financial markets. In addition to that adaptation to climate change will require investments, for e. g. public infrastructure. These additional expenses in e. g. public budgets and its potential effects on the financial market should be considered as well. Overall there seem to be a lot of open questions as for the links between climate change and the financial sector. There is a distinct need for further research and information which should be expressed. Some of this is summarized in the report "Requirements for the CLIMATE SERVICE CENTER (CSC) from the perspective of the financial sector", which outlines further information needs of insurers, banks and other participants in the financial markets on climate change and its impacts ( <a href="http://www.cfi21.org/fileadmin/user_upload/CSC-Bericht_englisch_web.pdf">http://www.cfi21.org/fileadmin/user_upload/CSC-Bericht_englisch_web.pdf</a> , page 4). (GERMANY) | The comment's recommendation has been picked up and a section on climate change impacts on the financial services sector (other than insurance) appended.   |
| 73 | 73021 | 10 | 4         | 5         | 4       | 8       | This summary statement is imprecise - that climate change impacts health - and the rest of the paragraph focuses on extreme events to the exclusion of other types of impacts. (UNITED STATES OF AMERICA)  | ES revised  |
| 74 | 61228 | 10 | 4         | 6         | 4       | 6       | The link between health and infrastructure issues is not made very explicit in the Executive Summary. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | ES revised  |
| 75 | 84608 | 10 | 4         | 8         | 4       | 8       | What kinds of economic consequences? Section 10.8.2 provides examples that are relevant to explaining this point. (Michael Mastrandrea, IPCC WGII TSU)   | ES revised  |
| 76 | 69076 | 10 | 4         | 10        | 4       | 11      | This sentence suggests that markets "would" (i.e. with certainty) reduce negative impacts and increase positive ones. But 10.9.1 indicates that markets can both exacerbate and mitigate negative impacts. Markets offer options for adaptation, but also can result in additional losses in other economic sectors. More accurate would be to say that markets "can" reduce negative impacts and increase positive ones. (NETHERLANDS)  | ES revised  |
| 77 | 69077 | 10 | 4         | 10        | 4       | 11      | There is no evidence present in the text to substantiate this statement. The finding was expressed in the text as an initial conclusion. This should be expressed as low evidence. (NETHERLANDS)   | confidence statements are included and details provided in section 10.9   |
| 78 | 84609 | 10 | 4         | 10        | 4       | 11      | It is unclear what other mechanisms markets are additional to, as presented here. Please clarify the comparison being made. (Michael Mastrandrea, IPCC WGII TSU)   | Text Revised  |
| 79 | 61229 | 10 | 4         | 10        | 4       | 13      | This paragraph needs redrafting to be more explicit about the role of markets in adaptation. On the one hand, well functioning economic markets do contribute to autonomous adaptation by easing economic adjustments to climate change; on the other hand, markets also contribute to spillover effects through product and input markets. Inadequate adaptation in one area would have negative implications elsewhere via trade effects (see PESETA II results: <a href="http://peseta.jrc.ec.europa.eu/">http://peseta.jrc.ec.europa.eu/</a> ). The last sentence could be deleted as it is not specific to the discussions presented in that chapter. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | Text Revised and chapter includes aggregate impacts section now.  |

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| 80 | 63564 | 10 | 4         | 10        | 4       | 13      | Markets have an important function organizing economic activities. But please consider the limitations of market mechanisms (market failures) as well. At least there should be the message that additional regulation and governance mechanisms are needed. Possible starting point for literature: - Kennedy, C. and J. Corfee-Morlot (2012), "Mobilizing Investment in Low Carbon, Climate Resilient Infrastructure", OECD Environment Working Papers, No. 46, OECD Publishing. <a href="http://dx.doi.org/10.1787/5k8zm3gxxmnq-en">http://dx.doi.org/10.1787/5k8zm3gxxmnq-en</a> - Agrawala Shardul and Maëlis Carraro (2010), "Assessing the role of microfinance in fostering adaptation to climate change", OECD Environmental Working Paper No. 15, 2010, OECD publishing, © OECD. doi: 10.1787/5kmlcz34fg9v-en (GERMANY)                                 | replaced "markets" by "well-functioning markets"   |
| 81 | 65915 | 10 | 4         | 10        | 4       | 13      | The statement that markets provide mechanisms for adaptation is controversial, please delete 'high agreement'. Recall, e.g. the studies of Amartya Sen and others that show how food markets can exacerbate the impacts of food shortage on the poor. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | confidences statements are consistent with author team's assessment  |
| 82 | 78904 | 10 | 4         | 10        | 4       | 13      | The bold statement as it stands appears too strong. Markets do not reduce negative impacts in any sector. E.g. where water is limited, water markets shift its use to the highest value uses, which actually increases the negative impacts on lower value use sectors. This qualification is included (sort of) in the last part of the para but the bold sentence itself needs rephrasing to avoid the bold sentence being wrong (and/or too easily misquoted and misunderstood). (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)   | text revised and full bullet includes important detail that not all sectors will be positively impacted.           |
| 83 | 73022 | 10 | 4         | 10        | 4       | 14      | Models often miss key intersectoral linkages that may have important implications for climate change. This occurs either because of the use of sector specific models that rely on partial equilibrium frameworks or because of the use of highly aggregate general equilibrium that cannot represent interactions at any level of detail. Please discuss. (UNITED STATES OF AMERICA)   | relevant discussion in the section text.   |
| 84 | 78903 | 10 | 4         | 15        | 4       | 17      | The Garnaut Report did a comprehensive economic analysis of climate change impacts for Australia, which would appear to be highly relevant to this chapter and this statement in particular. It should be referenced and assessed in the underlying section of this chapter. (Andy Reisinger, New Zealand Agricultural Greenhouse Gas Research Centre)  | Thank you. Authors reviewed the report to determine applicability and IPCC quality criteria.                       |
| 85 | 84610 | 10 | 4         | 16        | 4       | 17      | The use of "could" and "may" here makes it difficult to understand the extent to which these statements are supported by the literature or not. Please compare with the discussion in 10.9.2.3 and clarify here. (Michael Mastrandrea, IPCC WGII TSU)   | reviewed and language reflects team assessment.  |
| 86 | 63565 | 10 | 4         | 24        | 10      | 4       | There should be an additional remark that impacts on primary economic activities (e.g. food production) are dealt with in other chapters (e.g. ch. 7). Especially as for these sectors major climate impacts can be expected. Otherwise reading the summary of ch. 10 you could get the impression that there are no important impacts (esp. as this topics are taken up in ch. 10.5) or they have been neglected. (GERMANY)  | chapter content is clarified in multiple locations.  |
| 87 | 59455 | 10 | 4         | 38        | 0       | 41      | Please explain clearly why the food sector is not included in the list of economic sectors. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)   | Food is dealt with in Chapter 7.   |
| 88 | 73023 | 10 | 4         | 46        | 4       | 47      | The authors should confirm that cross-referenced chapters contain the promised materials. For example, the chapter claims that chapter 19 discusses welfare impacts. This seems a bit of an overstatement. Chapter 19 includes a discussion of the social cost of carbon, which is a welfare measure at the margin (for one additional or one less ton of carbon) but the aggregate welfare impact of climate change does not appear in that chapter. This begs the question of whether chapter 10 should include a discussion of the difference between GDP and welfare measures, since it focuses almost entirely on GDP as a way to communicate impacts - specifically what GDP measures miss and what they double count - and perhaps include a section summarizing the literature on aggregate welfare impacts of climate change. (UNITED STATES OF AMERICA) | Confirmed, and reorganized some sections for consistency and flow.   |
| 89 | 65916 | 10 | 4         | 48        | 4       | 48      | I would say the chapter focuses on „*monetized* economic activity“. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | too narrow   |
| 90 | 59457 | 10 | 5         | 0         | 10      | 0       | The economic sector of energy is very important and the climate change impact is analysed based on GDP mainly. The performed review does not provide information about energy poverty and the impact of climate change in indoor comfort which deteriorates due to the fact that people cannot cover the buildings' energy demand. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)  | Energy poverty is beyond the scope; incomes discussed as a major driver of change in demand for energy. No change. |
| 91 | 73024 | 10 | 5         | 1         | 6       | 5       | In general, the energy demand section is quite well written, but there is a decided lack of citations to support statements made in the text. (UNITED STATES OF AMERICA)  | added references   |

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| 92  | 71318 | 10 | 5         | 3         | 9       | 42      | It may be worth including a paragraph on the combined effect of climate change on various components of the electricity sector. For example, heat waves could concomitantly increase peak demand for electricity for air conditioning, while decreasing the efficiency of thermal electricity generation and electricity transmission. This is briefly addressed by: Mideksa, T. K., & Kallbekken, S. (2010). The impact of climate change on the electricity market: A review. Energy Policy, 38(7), 3579-3585. (CANADA)  | Added citation in 10.2.5.  |
| 93  | 82417 | 10 | 5         | 17        | 0       | 0       | Section 10.2.1. The citations relevant to this section should be clarified. The 1st paragraph refers to "most studies conducted since AR4," but seemingly only two citations are provided in this section. Also, it is not clear what "the assessed studies" refers to on line 27--the studies assessed in the underlying publication or in this section? If the latter, the relevant publication should be further clarified, for example to illustrate the basis for the described "general patterns" on line 36. (Katharine Mach, IPCC WGII TSU)  | Citations added.   |
| 94  | 65917 | 10 | 5         | 17        | 6       | 5       | To my knowledge there are much more studies that investigate the effect of weather and climate on energy demand. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | many studies now cited.  |
| 95  | 77172 | 10 | 5         | 19        | 0       | 0       | Section 10.2.1. The International Energy Agency's 2012 Energy Technology Perspectives also lists climate change impacts on the energy sector, looking both to the supply and demand side. On the demand side, besides mentioning the impacts already covered in this chapter, it points to climate induced migration as a potential energy demand shifter. (IEA, 2012, page 55, 5th paragraph). (ITALY)  | impacts on energy demand from climate-induced migration is very small compared to the many other drivers cited. No change. |
| 96  | 63397 | 10 | 5         | 19        | 5       | 20      | There is in general little research on impacts on electricity demand other than on cooling and heating degree days. Studies that should be mentioned here are De Cian, E.; Lanzi, E. & Roson, R. (2013), 'Seasonal temperature variations and energy demand - A panel cointegration analysis for climate change impact assessment', Climatic Change 116 (3-4), 805-825.; and Eskeland, G. S. & Mideksa, T. K. (2009), 'Climate Change Adaptation and Residential Electricity Demand in Europe' (2009:01), Technical report, Center for International Climate and Environmental Research (CICERO). (Anna Pechan, University of Oldenburg) | De Cian et al. cited; the other do not add to the already cited literature.  |
| 97  | 73026 | 10 | 5         | 27        | 0       | 0       | The text mentions "assessed studies" for Figure 10-1 but there is no information on multiple studies behind the data. (UNITED STATES OF AMERICA)   | Figure deleted.  |
| 98  | 73025 | 10 | 5         | 27        | 5       | 27      | Typo? Do you mean "countries" instead of "studies"? The figure seems to be based on only 1 study. (UNITED STATES OF AMERICA)   | Figure deleted.  |
| 99  | 84611 | 10 | 5         | 27        | 5       | 27      | Does this mean the assessed countries/states rather than studies? Or are these the countries/states relevant to studies assessed in Toth, 2013? Please clarify. (Michael Mastrandrea, IPCC WGII TSU)   | Figure deleted.  |
| 100 | 69078 | 10 | 5         | 27        | 5       | 28      | This sentence states that Figure 10-1 "sorts the assessed studies" according to... However, Figure 10-1 is a plot of GDP per capita vs. annual mean temperature for various countries and US states. It is unclear how this qualifies as a sorting of assessed studies. Suggest to alter the sentence to more accurately reflect the contents of the figure. (NETHERLANDS)   | Figure deleted.  |
| 101 | 77786 | 10 | 5         | 27        | 5       | 30      | Another misleading aspect of this figure is that in Canada and Finland, the majority of the population lives in the countries' warmest areas. This should be mentioned as a caveat. (Christian Reuten, RWDI AIR Inc.)  | Figure deleted.  |
| 102 | 81406 | 10 | 5         | 27        | 5       | 30      | Figure 10: As text states, "they help cluster the national and regional studies in the search for general findings," perhaps, the figure could explicitly illustrate some "clusters" (with highlighted regions, etc.) to demonstrate this point. (Yuka Estrada, IPCC WGII TSU)   | Figure deleted.  |
| 103 | 65050 | 10 | 5         | 27        | 5       | 41      | This statements establish a possible correlation between the GDP per capita and annual mean temperature as a drivers of the electricity demand under climate change scenario. There is not enough evidence to support this idea because the reference cited (Toth, 2013) is unpublished. (Meimalin Moreno, Instituto Venezolano de Investigaciones Cientificas)  | Figure deleted.  |
| 104 | 78928 | 10 | 5         | 27        | 5       | 41      | These statements establish a possible correlation between the GDP per capita and annual mean temperature as a drivers of the electricity demand under climate change scenario. There is not enough evidence to support this idea because the reference cited (Toth, 2013) is unpublished. These statements should be deleted from the document. (VENEZUELA, BOLIVARIAN REPUBLIC OF)  | Figure deleted, references supporting the conclusions provided.  |

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| 105 | 71319 | 10 | 5         | 27        | 5       | 42      | As currently configured, the discussion related to Figure 10-1 should be deleted. As noted in the text, neither indicator (mean annual temperature/GDP per capita) is ideal. Moreover, as the mean annual temperature indicator appears not to be population weighted, there is a bias for Canada. For example, the indicator appears to give the same weight to a temperature reading in Canada's North (e.g. Alqaluit) as to Toronto. If this discussion is to be retained, consideration should be given to estimate an population-weight mean temperature for each country represented in the Figure 10-1. (CANADA)  | Figure deleted. The general observations and conclusions from the cited literature remain valid.   |
| 106 | 67866 | 10 | 5         | 36        | 5       | 38      | Please show any references. A lot of high GDP countries locate in high latitudes where warmer temperature could reduce heating cost. And please also show if there were any other drivers/causes. (JAPAN)  | Figure deleted, references supporting the conclusions provided.  |
| 107 | 69079 | 10 | 5         | 36        | 5       | 39      | This sentence is structured in a convoluted manner. Suggest to rephrase it as follows: "The general patterns are as follows. In countries and regions with already high incomes, climate related changes in energy demand will be primarily driven by increasing temperatures. In countries/regions with high incomes and warm climates, increasing temperatures will be associated with heavier use of air conditioning. In countries/regions with high incomes and temperate and cold climates, increasing temperatures will result in lower demands for various energy forms (electricity, gas, coal, oil). Increasing incomes will play a marginal role in these countries and regions." (NETHERLANDS)   | Rephrasing done.   |
| 108 | 73027 | 10 | 5         | 36        | 5       | 41      | Are these findings from Toth (2013), or based on some other study? A citation should be included to support the statements in the paragraph. (UNITED STATES OF AMERICA)  | Figure deleted, references supporting the conclusions provided.  |
| 109 | 84612 | 10 | 5         | 36        | 5       | 41      | These general patterns are based on more than just Figure 10-1. Please clarify the rest of the evidence supporting these conclusions. Are they conclusions of Toth, 2013? (Michael Mastrandrea, IPCC WGII TSU)   | Figure deleted, references supporting the conclusions provided.  |
| 110 | 73028 | 10 | 5         | 39        | 0       | 0       | Increases in population and urbanization should not be neglected; income increases are not the only important factor in energy demand. (UNITED STATES OF AMERICA)  | population included in the last paragraph of 10.2.1, urbanization added.   |
| 111 | 67867 | 10 | 5         | 39        | 5       | 41      | Not every current low income country is subject to increased energy demand rapidly. See Chapter 5 in WG3. (JAPAN)  | The sentence does not imply countries; just states income as the main driver. No change.   |
| 112 | 59456 | 10 | 5         | 53        | 6       | 4       | Section 10.2.1 should conclude with an approximate quantitative estimate about the relative impact of climate change on energy demand in comparison with other driving factors (except income), such as demographics, households size etc. (Danae Diakoulaki, Chemical Engineering, NTUA, Greece) (GREECE)   | No literature was found about relative impacts of CC and other drivers. No change.   |
| 113 | 59458 | 10 | 6         | 1         | 6       | 1       | Relevant building codes and strict regulations (e.g. EPBD in Europe) will play a role as we move towards nearly zero energy buildings. In addition, the use of renewables in buildings. (Costas Balaras, Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Greece) (GREECE)  | Included.  |
| 114 | 77787 | 10 | 6         | 3         | 6       | 3       | Replace "selectric" by "electric" (Christian Reuten, RWDI AIR Inc.)  | Changed.   |
| 115 | 69080 | 10 | 6         | 7         | 6       | 7       | Section 10.2.2: No mention is made here to the vulnerability of biomass-based energy sources. Suggest at a minimum to provide a reference to another chapter/section of the report where the impacts of climate change on agriculture are discussed. (NETHERLANDS)   | Cross reference included.  |
| 116 | 65918 | 10 | 6         | 7         | 8       | 48      | Please harmonize the references of this section with those on cooling water (p 13, l 36-48). (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Cooling water discussion revised and moved to this section.  |
| 117 | 65920 | 10 | 6         | 7         | 8       | 48      | Lots of references are missing this section. The cooling water issue is studied in terms of the costs for single power plants (e.g. Förster, H. & Lilliestam, J. (2010) Modeling thermoelectric power generation in view of climate change, Regional Environmental Change, 10, 327-338. Koch, H. & Vögele, S. (2009) Dynamic Modelling of Water Demand, Water Availability and Adaptation Strategies for Power Plants to Global Change, Ecological Economics, 68, 2031-2039.), the nexus to water regulation (e.g. Eisenack, K. & Stecker, R. (2012) A framework for analyzing climate change adaptations as actions, Mitigation and Adaptation Strategies for Global Change, 17, 243-260. Stillwell, A. S.; King, C. W.; Webber, M. E.; Duncan, I. J. & Hardberger, A. (2011) The Energy-Water Nexus in Texas, Ecology and Society, 16, Art. 2.), and the effect on energy markets (e.g. Pechan, A. And Eisenack, K. (2013) The impact of heat waves on electricity spot market, Oldenburg Discussion Papers in Economics, V-357-13. Rübberke, D. & Vögele, S. (2011) Impacts of climate change on European critical infrastructures: The case of the power sector, Environmental Science and Policy, 14, 53-63.). A good overview of the issue is also given by Golombek, R.; Kittelsen, S. & Haddeland, I. (2012) Climate change: impacts on electricity markets in Western Europe, Climatic Change, 113, 357-370. and Mideksa, T. K. & Kallbekken, S. (2010) The impact of climate change on the electricity market: A review, Energy Policy, 38, 3579-3585. (Klaus Eisenack, Carl von Ossietzky University Oldenburg) | Cooling water discussion moved to this section. Checked proposed sources: some are cited, others do not add to the discussion based on those already cited. No change. |

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| 118 | 71320 | 10 | 6         | 8         | 7       | 27      | In general, the literature in this section is either thin or dated, hence the ability of lead and coordinating authors to draw hard and fast conclusions is quite limited. While the authors did flag the adverse impact of elevated temperatures on thermal power based technologies, including both fossil-fired and nuclear, it may be worth referencing recent events to the extent that literature is available on these events. For example, nuclear output has been derated in France during hot and dry spells and maximum cooling water discharge temperature limits have similarly adversely affected power output in North America. This is also the case for extreme weather adversely affecting coal production and shipping (due to flooded port lands) and extended droughts for hydro-based electricity. An additional consideration not mentioned is that given the increasing interconnections within and across national power systems, as a means of facilitating increasing levels of intermittent renewables into the network, the impact of lower water availability for hydro-rich systems can adversely affect generation of interconnected nations (Denmark wind being adversely affected by poor water conditions in Scandinavia). In addition, bio-fuel output will also be adversely affected by prolonged periods of below average rainfall and elevated temperatures, as was seen in the US during the past summer. It would be helpful to include actual impacts on both power output and fuel production over the past decade or longer if the data is readily obtainable. The other principal observation is that there will be an increasing allocation of capital towards both end-use efficiency and renewables in developed countries over the next several decades. In that light, the authors may wish to reflect more recent 2012 or 2013 estimates and outlooks (by IEA, BNEF, and REN) for the global power mix rather than cite studies dating back to 2010. (CANADA) | The most important sources are cited in Table 1. Six 2013 publications synthesize insights from recent literature; no need and no space to cite all their sources here, but a few references are added. The section provides a comprehensive assessment of CC and EWE impacts on the most important energy sources and technologies, including those with a very low share (~1%) in the current global energy mix, but it is beyond the mandate of this section to review estimates and outlooks about their shares in the future. References added. |
| 119 | 77173 | 10 | 6         | 9         | 0       | 0       | Section 10.2.2. The International Energy Agency's 2012 Energy Technology Perspectives also lists climate change impacts on the energy sector, looking both to the supply and demand side. On the supply side, besides mentioning impacts already covered in this chapter, it points to climate-induced political instability as a potential factor of disruption of secure supplies from energy producing countries. (IEA ,2012, page 54, 6th paragraph). Concerning the oil & gas sectors, IEA (2012) mentions moreover that offshore explorations can be disrupted by extreme weather events and that refineries could be shut down in areas increasingly exposed to hurricanes (IEA 2012, p.54, 7th paragraph). (ITALY)  | Climate-induced political instability may well affect supply security but it is a remote indirect impact, beyond the scope of this chapter. Oil and gas impacts are covered. No change.  |
| 120 | 73029 | 10 | 6         | 10        | 0       | 0       | "operation" of what? Please clarify. (UNITED STATES OF AMERICA)   | Clarified.   |
| 121 | 84613 | 10 | 6         | 10        | 6       | 12      | Although it is implicit, it would be useful to state explicitly here the linkage between climate change and potential changes in the frequency of extreme weather events. (Michael Mastrandrea, IPCC WGII TSU)  | Linkage included.  |
| 122 | 59986 | 10 | 6         | 11        | 6       | 11      | Suggest that extreme weather events should not be abbreviated to 'EWEs'. (AUSTRALIA)  | Keep EWE to make the text flow better. Final decision left to copy editor.   |
| 123 | 73030 | 10 | 6         | 11        | 6       | 11      | Are EWEs defined precisely elsewhere in the report? If so, please refer the reader to the chapter that explains what types of events are included in EWEs. If not, please explain how it is being defined for purposes of this chapter. (UNITED STATES OF AMERICA)  | Definition and references to Glossary provided.  |
| 124 | 61225 | 10 | 6         | 15        | 6       | 16      | Table 10.1. Impacts of CC and EWEs on energy supply. The table also lists adaptation options. References should be listed in the table next to the relevant study and not listed under the table. This could be done the same way as in table 10-6 (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | Table title changed to include adaptation. References (removed in response to comments received on ZOD) are reintroduced.  |
| 125 | 73031 | 10 | 6         | 19        | 0       | 0       | What is the range of estimates for thermal power as a percent of total electricity generation? (UNITED STATES OF AMERICA)   | Varies country by country but beyond the scope of the chapter. See also response to comment 118.   |
| 126 | 63566 | 10 | 6         | 19        | 6       | 20      | Technically wrong: power plants have to be constructed for certain climatic conditions. Change: "Thermal power plants can be designed to operate under ... and are normally well adapted to a given climate." (GERMANY)   | Rephrased.   |
| 127 | 63412 | 10 | 6         | 24        | 6       | 24      | How do you come to the conclusion, that the Carnot effect is "the most significant impact of CC on thermal power plants"? What is the reference for this statement? (Anna Pechan, University of Oldenburg)  | Rephrased.   |
| 128 | 65919 | 10 | 6         | 24        | 6       | 25      | The effect from Carnot's theorem is not the most significant impact. One could at most say „One significant impact of CC...“. This effect reduces technical plant efficiency by less than 1% per 1K increase in temperature, and even less for modern coal-fired power plants. (see, e.g. Linnerud, K.; Mideksa, T. K. & Eskeland, G. (2011) The Impact of Climate Change on Nuclear Power Supply, The Energy Journal, 32, 149-168. Rothstein, B. and Schroedter-Homscheidt, M. and Häikfner, C. and Bernhardt, S. and Mimler, S. (2008) Impacts of climate change on the electricity sector and possible adaptation measures, in: Hansjürgens, B. and Antes, R. (Eds.) Economics and Management of Climate Change, Springer.) (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Rephrased.   |

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| 129 | 65921 | 10 | 6         | 24        | 6       | 25      | The most significant impact of CC of thermal power generation (with large-scale power plants) is due to the potential shortage of cooling water. The extent of this problem depends on the geographical conditions, the siting of power plants, and the water regulation. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Rephrased.   |
| 130 | 73032 | 10 | 6         | 24        | 6       | 25      | Carnot's rule is prominently mentioned at least twice. Since the rule is unfamiliar to many, suggest defining or explaining it, perhaps in a text box. Also, how large is this Carnot effect in terms of reduced energy efficiency of thermal power plants as ambient temperature increases? (UNITED STATES OF AMERICA)  | Carnot's rule deleted.   |
| 131 | 65927 | 10 | 6         | 24        | 6       | 47      | Please add more on the regulatory / water use conflict dimension of the cooling water problem. This is most likely the main issue here (see, e.g. Förster, H. & Lilliestam, J. (2010) Modeling thermoelectric power generation in view of climate change, Regional Environmental Change, 10, 327-338. Eisenack, K. & Stecker, R. (2012) A framework for analyzing climate change adaptations as actions, Mitigation and Adaptation Strategies for Global Change, 17, 243-260. Stillwell, A. S.; King, C. W.; Webber, M. E.; Duncan, I. J. & Hardberger, A. (2011) The Energy-Water Nexus in Texas, Ecology and Society, 16, Art. 2. ) (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Cooling water discussion revised and moved to this section, including pertinent references.  |
| 132 | 59987 | 10 | 6         | 25        | 6       | 25      | Carnot's rule should be explained. Suggested rewording: This is a principle of thermodynamics, Carnot's rule, which specifies limits of the maximum efficiency any heat engine can achieve. (AUSTRALIA)  | Carnot's rule deleted.   |
| 133 | 73033 | 10 | 6         | 27        | 0       | 0       | Consider explaining what is meant by supercritical and ultra-supercritical. (UNITED STATES OF AMERICA)   | Explanation added.   |
| 134 | 63398 | 10 | 6         | 30        | 6       | 33      | It should be mentioned here that in such situations a conflict between environmental protection and energy security can arise; Ott & Richter (2008) is not among the most relevant papers on this issue; Rather to be included here are: Koch, H. & Vögele, S. (2009), 'Dynamic Modelling of Water Demand, Water Availability and Adaptation Strategies for Power Plants to Global Change', Ecological Economics 68 (7) , 2031-2039 . ; Linnerud, K.; Mideksa, T. K. & Eskeland, G. (2011), 'The Impact of Climate Change on Nuclear Power Supply', The Energy Journal 32 (1) , 149-168 . ; van Vliet, M. T. H.; Yearsley, J. R.; Ludwig, F.; Vögele, S.; Lettenmaier, D. P. & Kabat, P. (2012), 'Vulnerability of US and European electricity supply to climate change', Nature Climate Change 2 (9) , 676-681 . ; Rübhelke, D. & Vögele, S. (2011), 'Impacts of climate change on European critical infrastructures: The case of the power sector', Environmental Science and Policy 14 (1) , 53-63 . ; Förster, H. & Lilliestam, J. (2010), 'Modeling thermoelectric power generation in view of climate change', Regional Environmental Change 10 (4) , 327-338 . (Anna Pechan, University of Oldenburg) | Energy security is beyond the scope of this section. Cooling water is covered by the paragraphs moved from the water section. Ott & Richter deleted, van Vliet et al. cited. |
| 135 | 65922 | 10 | 6         | 30        | 6       | 33      | Even more severe: cooling water scarcity lead to blackouts when too much power plants need to be shut down. This was already a serious concern in the European 2003 heat waves and led to regulatory adjustments (see Eisenack, K. & Stecker, R. (2012) A framework for analyzing climate change adaptations as actions, Mitigation and Adaptation Strategies for Global Change, 17, 243-260. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Shutdowns already included; no change.   |
| 136 | 63413 | 10 | 6         | 30        | 6       | 42      | The outline of water regulation in place plays a significant role here; restrictions of water discharge and exemptions from such restrictions determine the extent of the actual impact on thermal power plants and can be an (institutional) adaptation (see: Eisenack, K. & Stecker, R. (2012), 'A framework for analyzing climate change adaptations as actions', Mitigation and Adaptation Strategies for Global Change 17 (3) , 243-260 . ; Stillwell, A. S.; King, C. W.; Webber, M. E.; Duncan, I. J. & Hardberger, A. (2011), 'The Energy-Water Nexus in Texas', Ecology and Society 16 (1) , Art. 2 . ; Förster, H. & Lilliestam, J. (2010), 'Modeling thermoelectric power generation in view of climate change', Regional Environmental Change 10 (4) , 327-338 . ) (Anna Pechan, University of Oldenburg)  | Institutional adaptation and citation added.   |
| 137 | 71321 | 10 | 6         | 35        | 0       | 0       | The knowledge and the technologies for Carbon Capture and Storage (CCS) have evolved since 2005. Therefore, the reference to IPCC (2005) regarding the current efficiency penalty for CCS could be updated. The 2012 Status report of the Global Carbon Capture and Storage Institute (GCCSI) could be used as a source to update the data. (CANADA)   | IPCC 2005 replaced by a 2009 US DOE/NETL publication.  |
| 138 | 65923 | 10 | 6         | 37        | 6       | 39      | Add following adaptation options: siting decisions for new power plants, shifting to small-scale thermal power plants or non-thermal power plants as renewables (see, e.g. . Pechan, A. And Eisenack, K. (2013) The impact of heat waves on electricity spot market, Oldenburg Discussion Papers in Economics, V-357-13. Strauch, U. (2011) Wassertemperaturbedingte Leistungseinschränkungen konventioneller thermischer Kraftwerke in Deutschland und die Entwicklung rezenter und zukünftiger Flusswassertemperaturen im Kontext des Klimawandels, PhD Thesis, University of Würzburg, Germany. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Cite selection included in the text.   |

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| 139 | 65924 | 10 | 6         | 44        | 6       | 45      | Odd phrasing: nuclear power plant are also thermal, and not counterparts to thermal power plants. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | phrasing corrected, distinction explained.  |
| 140 | 71322 | 10 | 6         | 44        | 6       | 45      | This sentence seems to imply that nuclear electricity is not a type of thermal electricity while, in fact, it is. (CANADA)   | phrasing corrected, distinction explained.  |
| 141 | 65926 | 10 | 6         | 44        | 6       | 47      | Consider joining the paragraph on nuclear with that of thermal power generation (p 6   24-25). The impacts and adaptations are qualitatively the same. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | phrasing corrected, distinction explained.  |
| 142 | 65925 | 10 | 6         | 45        | 6       | 46      | Carnot's theorem effects nuclear slightly more severely as coal, since the temperature in the condenser is much lower. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Carnot deleted. No change.  |
| 143 | 59988 | 10 | 6         | 45        | 6       | 47      | Suggest rewording to remove jargon which is the reference to 'Carnot's rule': While efficiency limits remain, a range of alternative cooling options are available to deal with..." (AUSTRALIA)  | Carnot deleted.   |
| 144 | 73034 | 10 | 6         | 47        | 6       | 47      | Is there something more recent than EPA (2001) to include as a reference here? Perhaps something by Szabo; e.g., <a href="http://acc-usersgroup.org/wp-content/uploads/2011/11/AGregasz-Nuclear-Pl...">http://acc-usersgroup.org/wp-content/uploads/2011/11/AGregasz-Nuclear-Pl...</a> , <a href="http://acc-usersgroup.org/wp-content/uploads/2012/11/10-Safe-and-Economi...">http://acc-usersgroup.org/wp-content/uploads/2012/11/10-Safe-and-Economi...</a> , or literature cited therein may provide useful leads. (UNITED STATES OF AMERICA)  | EPA 2001 replaced by a more recent source in the text; more sources cited in Table 1. |
| 145 | 71323 | 10 | 7         | 4         | 7       | 4       | In fact, bioenergy is the largest renewable energy source in the current energy mix globally, even when only taking into account modern biomass (IPCC, 2011: Summary for Policymakers. In: IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation). Suggest replacing by: "Hydropower is by far the largest of renewable energy sources in the current electricity mix (i.e. not energy mix)." (CANADA)   | corrected.  |
| 146 | 59989 | 10 | 7         | 10        | 7       | 11      | Reword sentence as there is no method for measuring how complex impact assessments are. Wording: Assessing the impacts of climate change on hydropower generation is highly complex. (AUSTRALIA)   | rephrased.  |
| 147 | 69081 | 10 | 7         | 10        | 7       | 11      | Assessing the impacts of climate change on hydropower generation is - as described in this paragraph - a highly complex endeavor. However, insufficient evidence is presented with respect to this task being "the most complex endeavor in the energy sector". Suggest to restate as follows: "Assessing the impacts of climate change on hydropower generation is a highly complex endeavour." (NETHERLANDS)   | rephrased.  |
| 148 | 73035 | 10 | 7         | 10        | 7       | 11      | No reference is provided for the statement that predicting the effects of GCC on hydropower is the most complex endeavor in the energy sector. Do all experts agree with this? (UNITED STATES OF AMERICA)  | rephrased.  |
| 149 | 77788 | 10 | 7         | 11        | 7       | 15      | Another complicating factor that should be mentioned is the non-linear climate response of glaciers, which are often important seasonal contributors to reservoir levels. Changes include timing and amount of glacier melt. (Christian Reuten, RWDI AIR Inc.)   | added.  |
| 150 | 69082 | 10 | 7         | 19        | 7       | 23      | This sentence is confusingly formulated, in particular the phrase "the impacts of CC and EWEs on hydropower generation is likely to increase in most regions and decrease in some". Does this mean that CC and EWEs will increase hydropower generation in most regions, or that the impacts on hydropower generation will become increasingly severe? Suggest to rephrase to clarify this. (NETHERLANDS)  | rephrased.  |
| 151 | 71324 | 10 | 7         | 19        | 7       | 23      | Sentence is hard to understand as is. Suggest simplifying and replacing it by: "The overall conclusion from the literature is that the impacts of CC are likely to increase hydropower generation in most regions and decrease it in some, with diverging patterns across regions, watersheds and river basins." (CANADA)  | rephrased.  |
| 152 | 59990 | 10 | 7         | 19        | 7       | 25      | The first sentence is too long and includes multiple references to 'CC' which should be replaced with 'climate change'. The paragraph could be improved by rewording: The overall conclusion from the literature is that impacts of climate change and extreme weather events on hydropower generation is likely to increase in most regions but that the effects will differ between regions, watersheds within regions and even river basins within watersheds. Adaptation responses and planning tools for long-term hydrogeneration may need to be enhanced to cope with slow but persistent changes in water availability. Short-term management models may need to be enhanced to deal with impacts of extreme weather events. (AUSTRALIA) | acronyms make the text easier to read; sentence rephrased.                            |

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| 153 | 73036 | 10 | 7         | 19        | 7       | 28      | This paragraph could be improved with some specifics on why hydropower may be affected by climate change. The impact of climate change on hydroelectric generation is location specific. However, even if precipitation levels are unchanged, a shift in composition from snow to rain and a warming climate will generally produce earlier and more rapid run-off, with a sharper peak flow in the spring. Dams built for existing conditions will have difficulty managing sharper peaks. Greater variability in flows and reduced predictability of flows will complicate water management dilemmas, including, inter alia, the effective management of water flows to generate electricity. (UNITED STATES OF AMERICA)  | these impacts are mentioned in the preceding paragraph and in Table 1. No change.  |
| 154 | 82418 | 10 | 7         | 21        | 7       | 21      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)   | rephrased.   |
| 155 | 62553 | 10 | 7         | 29        | 7       | 30      | It would be useful to draw on studies beyond the IEA studies, including the outcome of IAMs. For example, there is an Asian modelling study that would be worth drawing on. Asian Modeling Exercise), Energy Economics Special Issue 2012, Calvin, K., L. Clarke & V.Krey (eds) (INDIA)   | Regional impacts should be reported in regional chapters. No change.   |
| 156 | 73037 | 10 | 7         | 29        | 7       | 30      | What is the range of projections for increased solar energy use, by type? (UNITED STATES OF AMERICA)  | Beyond scope of this chapter; WGIII domain. No change.   |
| 157 | 59459 | 10 | 7         | 31        | 7       | 32      | change the order of reference to solar collector types from simple (low cost, low efficiency) unglazed collectors to (higher cost, higher efficiency) concentrating collectors.(Costas Balaras, Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Greece) (GREECE)  | The cost of collectors does not influence CC impacts. No change.   |
| 158 | 85123 | 10 | 7         | 45        | 7       | 46      | In the AR5 context, exposure and vulnerability are considered separate (see AR5 WGII Glossary). As characterized in Chapter 19 and the draft SPM and TS, both interact with physical climate changes to determine risks. Please consider the terminology here and its consistency with the glossary. (Michael Mastrandrea, IPCC WGII TSU)   | Double-checked Glossary; use of terms is consistent. Sensitive material is exposed and this is a predisposition to be affected adversely. No change. |
| 159 | 59991 | 10 | 7         | 51        | 7       | 51      | Deploying solar technologies are not as vulnerable to climate change and extreme weather events when compared some of the other energy generation technologies. See Patt, A, S Pfenninger, J Lilliestam (2010) Vulnerability of solar energy infrastructure and output to extreme events: climate change implications, Paper prepared for presentation at the Joint ICTP/IAEA Workshop on Vulnerability of Energy Systems to Climate Changes and Extreme Events, 22 April 2010, Trieste, Italy, <a href="http://webarchive.iiasa.ac.at/Admin/PUB/Documents/XO-10-026.pdf">http://webarchive.iiasa.ac.at/Admin/PUB/Documents/XO-10-026.pdf</a> and Schaeffer, R, A S Szklo, A F Pereira de Lucena, B S M C Borba, L P P Nogueira, F P Fleming, A Troccoli, M Harrison, M S Boulahya, 2012, Energy sector vulnerability to climate change: A review, Energy, Vol.38(1) pp1-12 (AUSTRALIA) | Relative vulnerability not discussed; Patt et al. 2013 paper cited. No change.   |
| 160 | 59992 | 10 | 7         | 53        | 7       | 54      | Reword to improve clarity: An objective of these development efforts is to make make the next generation of solar technologies less vulnerable to existing physical challenges, changing climatic conditions and the impact of extreme weather events. (AUSTRALIA)  | Rephrased as suggested.  |
| 161 | 65851 | 10 | 8         | 0         | 0       | 0       | section 10.7 Insurance is much larger than other containing important issues. Authors may wish to shorten it. (Milton Nogueira da Silva, Climate Change Forum of Minas Gerais, Brazil)  | Insurance, not energy. No change here.   |
| 162 | 59460 | 10 | 8         | 4         | 8       | 9       | Include some reference to small size wind turbines for applications (integration) in buildings. (Costas Balaras, Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Greece) (GREECE)   | This is not a significant portion of wind power and CC impacts. No change.   |
| 163 | 59993 | 10 | 8         | 5         | 8       | 6       | Reword to improve clarity. For example: Assessing possible impacts of climate change and extreme weather events and identifying possible adaptation responses for wind energy is complicated by the complex dynamics characterising this generation source. (AUSTRALIA)   | Rephrased as suggested.  |
| 164 | 69083 | 10 | 8         | 13        | 8       | 15      | It is not clear precisely how these numbers have been derived from the reference, nor to what geographical area they pertain. The +/- 50% number is not directly stated in the reference. Table 10-1 suggests that the +/- 50% number relates specifically to Europe and North America, but this is not stated in the text. (NETHERLANDS)   | Europe and North America added, source corrected.  |
| 165 | 65928 | 10 | 8         | 13        | 8       | 17      | The range +/- 50% is not very informative. I think, these differences primarily stem from the different geographical conditions around the world, and not so much from uncertainty? Please clarify this. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | the +/- 50% is the range across scenarios for Europe and North America. Text rephrased.  |
| 166 | 73038 | 10 | 8         | 29        | 0       | 0       | What is open cast mining? Please explain. (UNITED STATES OF AMERICA)  | Changed to surface mining.   |
| 167 | 71325 | 10 | 8         | 34        | 8       | 36      | Suggest cutting sentence given that the issue of water efficiency and CCS is already covered earlier in the section (p. 6, lines 34-35), with regards to thermal electricity generation. If not, the source should be updated by, for example, The 2012 Status report of the Global Carbon Capture and Storage Institute (GCCSI) could be used as a source to update the data. (CANADA)   | sentence deleted.  |



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| 168 | 73039 | 10 | 8         | 36        | 0       | 0       | A reference is needed on water use for sequestration. (UNITED STATES OF AMERICA)   | Sentence deleted; reference added in the paragraph about thermal generation.   |
| 169 | 73040 | 10 | 8         | 43        | 8       | 45      | All the examples given are risks for the oil and gas industry. It should be noted that this could also open new areas for oil and gas exploration, potentially increasing the technically recoverable resource base. (e.g., USGS estimates that 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic, of which approximately 84 percent is expected to occur in offshore areas See <a href="http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf">http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf</a> . ) Or if covered elsewhere, then refer the reader to the relevant ch, section. (UNITED STATES OF AMERICA)   | Arctic potential included.   |
| 170 | 73041 | 10 | 8         | 51        | 9       | 42      | While the IPCC AR5 encompasses multiple scenarios, this section primarily conceptualizes climate impacts in terms of a business as usual scenario. Please refer readers to the appropriate chapter of WGIII for a discussion of impacts under various mitigation scenarios. (UNITED STATES OF AMERICA)   | this section discusses impacts and adaptation options in general. Discussing impacts under different scenarios is beyond the scope.  |
| 171 | 73042 | 10 | 8         | 52        | 9       | 43      | We see no discussion of how challenges in the transport and transmission of energy may affect grid reliability. Changes in grid reliability will, in turn, affect energy demand. This seems like an important consideration to include in the chapter. (UNITED STATES OF AMERICA)  | grid reliability is explicitly discussed as a function of CC and EWEs. It is not clear how grid reliability would effect energy demand: less reliable grid = lower demand, or? |
| 172 | 65929 | 10 | 9         | 1         | 9       | 3       | Please also mention an energy-related adaptation here, namely increasing storage capacity for primary energy input close to power plants in order avoid shortage during longer transport disruption. This adaptation is likely to entail substantial adaptation costs. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | storage is a general adaptation option for types of goods, not only energy, affected by transport disruptions. See transport section. No change here.                          |
| 173 | 73043 | 10 | 9         | 11        | 9       | 11      | Insert "potential" between the words "the spread". Given the current lack of widespread diffusion, of CCS, the text as it stands sounds hypothetical. (UNITED STATES OF AMERICA)   | inserted.  |
| 174 | 71326 | 10 | 9         | 13        | 9       | 13      | Recommend using the usual terminology, which is "storage", not "disposal". (CANADA)  | changed to storage.  |
| 175 | 73044 | 10 | 9         | 15        | 9       | 17      | This nuance is missing from the executive summary discussing the effects on pipelines and should be reflected there. (UNITED STATES OF AMERICA)  | "largely available" inserted in ES.  |
| 176 | 59994 | 10 | 9         | 19        | 9       | 20      | Australia has done some work in this area. Suggest rewording to: Pipelines will be mainly affected by secondary impacts of climate change: sea-level risk in coastal regions, melting permafrost in cold regions, floods washing away infrastructure, landslides triggered by heavy rainfall, and bushfires triggered by heat waves or extreme temperatures in hot regions (Smith, M, 2012, Assessing climate change risks and opportunities for investors: Oil and gas sector, Australian National University and Investor Group on Climate Change, Canberra, <a href="http://www.igcc.org.au/Resources/Documents/oil_gas_assessing_climate_change_risks_for_investors.pdf">http://www.igcc.org.au/Resources/Documents/oil_gas_assessing_climate_change_risks_for_investors.pdf</a> (AUSTRALIA)   | reworded as suggested.   |
| 177 | 77789 | 10 | 9         | 19        | 9       | 22      | Include in the enumeration of impacts: reduced line-heating and dilution needs due to reduces viscosity of liquid fuels under warmer temperatures; and increased danger from wildfires caused but higher temperatures, less precipitation, and increased tree death due to pests like the pine beetle. (Christian Reuten, RWDI AIR Inc.)   | viscosity impact included; others also listed.   |
| 178 | 59995 | 10 | 9         | 20        | 9       | 22      | Suggest including an example of 'risk-based design'. Rewording suggestion: A proposed way to reduced vulnerability to these events is to amend land zoning codes, risk-based design and construction stadnards for new pieplines, and structural upgrades to existing infrastructure (Antonioni, et al 2009; Cruz and Krausmann 2013; and Krausmann, et al 2011). Krausmann, E, V Cozzani, E Salzano and E Renni, 2011, Industrial accidents triggered by natural hazards: an emerging issue, Natural Hazards and Earth Systems Sciences, 11, 921-929. <a href="http://www.nat-hazards-earth-syst-sci.net/11/921/2011/nhess-11-921-2011.pdf">http://www.nat-hazards-earth-syst-sci.net/11/921/2011/nhess-11-921-2011.pdf</a> (AUSTRALIA)   | reworded as suggested; reference added.  |
| 179 | 59996 | 10 | 9         | 25        | 9       | 28      | Suggest rewording sentence to improve clarity: The power industry has developed numerous technical solutions and related standards to protect assets and provide reliable electricity supply under existing climate and weather conditions. However, these assets and the reliability of supply are likely to be vulnerable to changes in the frequency and intensity of extreme weather events under changing climate conditions. If a reference is required, could use: Wilbanks, T.J., V. Bhatt, D.E. Bilello, S. R. Bull, J. Ekmann, W. C. Horak, Y.J.Huang, M.D. Levine, M.J.Sale, D.K. Schmalzer, and M.J.Scott (eds), 2007, Effects of climate change on energy production and use in the United States, A Report by the US Climate change Science Program and the subcommittee on Global Change Research, Department of Energy, Office of Biological and Environmental Research, Washington DC (AUSTRALIA) | reworded as suggested; reference added.  |

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| 180 | 65930 | 10 | 9         | 25        | 9       | 28      | Elaborte more on adaptation options. Underground cables are another important technical options. Institutionally, a redefinitions of technical standards may be recommended. Furthermore, existing grid regulation needs to be tested whether it sets the right incentives for grid operators to provide appropriate adaptation. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | reworded as suggested; reference added.   |
| 181 | 65931 | 10 | 9         | 25        | 9       | 28      | Adaptation of the grid is likely to be cheap if it starts early but is undertaking within regular re-investment cycles. If this is not done, retrofit is likely to become expensive. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | text added.   |
| 182 | 63414 | 10 | 9         | 30        | 9       | 30      | To what does the relation 0.4%/°C refer? To air temperatures or to line temperature? How is the cooling effect of wind speeds reflected in this number? Is the relation indeed linear for all temperatures or does it only applicable from a certain threshold upwards? (Anna Pechan, University of Oldenburg)   | number deleted because source is unclear, statement about the general relationship kept. Reference added.   |
| 183 | 65932 | 10 | 9         | 30        | 9       | 31      | Please clarify the meaning of the 0.4% number. I think it refers to the cable temperature affecting the transmission capacity (for that I've heard higher numbers from energy industry representatives). Cable temperature is different from the air temperature, as the wind also affects the cable temperature. I don't understand what is meant by „transmission efficiency“. A reduced transmission capacity is only problematic if the line is congested. (Klaus Eisenack, Carl von Ossietzky University Oldenburg) | number deleted, statement about the general relationship kept. Reduce transmission efficiency means reduced carrying capacity. Reference added.   |
| 184 | 79529 | 10 | 9         | 30        | 9       | 31      | Does Ward, 2013 give actual figures on the transmission efficiency losses relative to those caused by EWE? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | No, number deleted, additional source added.  |
| 185 | 63399 | 10 | 9         | 30        | 9       | 36      | Underground cables are not mentioned here, they might be affected by higher temperatures and drier soils and/or can be adaptation measures for overhead lines (see Mideksa, T. K. & Kallbekken, S. (2010), 'The impact of climate change on the electricity market: A review', Energy Policy 38 (7) , 3579-3585 . ) (Anna Pechan, University of Oldenburg)   | underground cables added in earlier paragraph.  |
| 186 | 77790 | 10 | 9         | 30        | 9       | 36      | Include in the enumeration of impacts: increased danger from wildfires caused but higher temperatures, less precipitation, and increased tree death due to pests like the pine beetle. (Christian Reuten, RWDI AIR Inc.)   | included.   |
| 187 | 65934 | 10 | 9         | 31        | 9       | 31      | References for Ward (2013) are incomplete. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | reference fixed.  |
| 188 | 73045 | 10 | 9         | 31        | 9       | 33      | What about the impacts of winter storms/ice damage? (UNITED STATES OF AMERICA)   | included.   |
| 189 | 65933 | 10 | 9         | 38        | 9       | 41      | There are studies on the estimated costs of blackouts, e.g. de Nooij, M.; Lieshout, R. & Koopmans, C. (2009) Optimal blackouts: Empirical results on reducing the social cost of electricity outages through efficient regional rationing, Energy Economics, 31, 342-347. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Text and reference added.   |
| 190 | 71327 | 10 | 9         | 51        | 9       | 52      | With respect to Table 10-3, consideration should be given to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details in table will make it difficult to read |
| 191 | 82419 | 10 | 10        | 4         | 10      | 4       | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)  | IPCC guidance followed in SOR, no change.   |
| 192 | 59997 | 10 | 10        | 10        | 10      | 10      | Please provide reference to the two global studies in which the regions listed appear. (AUSTRALIA)   | Done.   |
| 193 | 73046 | 10 | 10        | 10        | 10      | 13      | Explain reasons why developing countries will have greater negative GDP impacts on energy sector due to climate change. (UNITED STATES OF AMERICA)   | Done.   |
| 194 | 82420 | 10 | 10        | 11        | 10      | 11      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)  | IPCC guidance followed in SOR, no change.   |
| 195 | 73047 | 10 | 10        | 15        | 10      | 18      | Is this list of extreme weather phenomena meant to be exhaustive? If so, should fires be added to the list? (UNITED STATES OF AMERICA)   | Done.   |
| 196 | 73048 | 10 | 10        | 28        | 10      | 30      | Are these the projected effects on energy GDP globally or for a particular country? If global, it obscures differences in country effects since some may increase while others decrease. (UNITED STATES OF AMERICA)  | No change. These are effects on country (Jochem et al.) and country/region (Bosello et al.) GDP, not global GDP   |
| 197 | 71328 | 10 | 10        | 29        | 10      | 30      | Consideration should be given to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable        |

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| 198 | 73049 | 10 | 10        | 32        | 0       | 0       | What are the 6 other climate effects considered in that study? (UNITED STATES OF AMERICA)  | No change. Impacts are listed in table 10-3. Listing them in text would be redundant.   |
| 199 | 73050 | 10 | 10        | 35        | 10      | 51      | GDP decreases of 1 to 3% should not be described as "moderate". Delete the adjective and just list the numbers. Also, these numbers are meaningless unless you also cite the mean global temperature increase and time frame that each of the different studies used. (UNITED STATES OF AMERICA)   | replaced "quite modest at" to "in the range of" and "moderate" to "similar"   |
| 200 | 71329 | 10 | 10        | 36        | 10      | 37      | Consideration should be given to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 201 | 71330 | 10 | 10        | 42        | 10      | 42      | Consideration should be given to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 202 | 73051 | 10 | 10        | 43        | 0       | 0       | Are there no quantified estimates from Eboli et al? If not, does this study deserve citing here? (UNITED STATES OF AMERICA)  | No change. Given the limited literature available, results presented qualitatively can still contribute to our understanding of the issue.  |
| 203 | 71331 | 10 | 10        | 48        | 10      | 51      | Consideration should be given to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 204 | 63400 | 10 | 10        | 53        | 11      | 13      | Not mentioned here are the study of Rübbelke, D. & Vögele, S. (2013), 'Short-term distributional consequences of climate change impacts on the power sector: who gains and who loses?', Climatic Change 116 (2) , 191-206 . , and an econometric study by McDermott, G. R. & Nilsen, Ø. A. (2011), 'Electricity Prices, River Temperatures and Cooling Water Scarcity' (SAM 18/2011) , Technical report, Department of Economics, Norwegian School of Economics . (Anna Pechan, University of Oldenburg) | Done. Thanks for the additional references  |
| 205 | 63418 | 10 | 10        | 53        | 11      | 13      | Pechan & Eisenack (2013) show that thermal capacity reductions can have a relevant impact on electricity prices, which is likely to increase with further climate change and can be reduced with an shift towards renewable energies (see Pechan, A. and Eisenack, K. (2013): The Impact of Heat Waves on Electricity Spot Markets, Oldenburg Economic Discussion Paper, V-357-13 (Anna Pechan, University of Oldenburg)   | Done. Thanks for the additional references  |
| 206 | 65935 | 10 | 10        | 53        | 11      | 13      | This section would better fit to the earlier on energy supply (p 6 l 24-47) (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | no change. Beyond the author's scope.   |
| 207 | 59461 | 10 | 11        | 0         | 14      | 0       | Regarding water and its economic impact, one important issue that may be mentioned is the water recycling or reusing efforts (grey water, etc). (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)  | although water reuse and recycling is important in the context of cooling system adaptation to climate change, this section does not go into any of the details with respect to adaptation options and focuses instead on the market and economic impacts of climate change and extreme weather |
| 208 | 71332 | 10 | 11        | 1         | 11      | 2       | Consideration should be given to including the \$ level impacts in addition to the % Change in the price of electricity. Providing only the % change does not provide a sense of impact implied. (CANADA)  | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 209 | 71333 | 10 | 11        | 5         | 11      | 5       | Consideration should be given to including the \$ level impacts in addition to the % Change in the price of electricity. Providing only the % change does not provide a sense of impact implied. (CANADA)  | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 210 | 69084 | 10 | 11        | 6         | 11      | 6       | Better to use a peer-reviewed reference here (instead of Bye et al, 2006). Suggest to use Bye T., Bruvoll A., Aune F.R. (2008) Inflow shortages in deregulated power markets - Reasons for concern? Energy Economics 30(4):1693-1711. (NETHERLANDS)  | Done.   |
| 211 | 73052 | 10 | 11        | 6         | 11      | 9       | These are meaningless numbers unless information is presented on the drought severity and duration assumptions. Also, note that these are very location-specific and dependent on the share of hydro in electric power production. (UNITED STATES OF AMERICA)  | Will add climate scenario information where available from studies.   |

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| 212 | 71334 | 10 | 11        | 8         | 11      | 8       | Consideration should be given to including the \$ level impacts in addition to the % Change in the price of electricity. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable |
| 213 | 84614 | 10 | 11        | 18        | 11      | 24      | As mentioned in the context of the ES, this material is relevant to the corresponding ES finding, but is not captured there. (Michael Mastrandrea, IPCC WGII TSU)   | wrote paragraph for possible inclusion in ES   |
| 214 | 82421 | 10 | 11        | 19        | 11      | 19      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)   | IPCC guidance followed in SOR, no change.  |
| 215 | 68178 | 10 | 11        | 19        | 11      | 21      | This sentence ("increase in temperature will decrease.....the potential and dependability of hydropower") implies that climate change will lead to decreased hydropower production in all reservoirs, whereas earlier statements in the same document note that some hydropower reservoirs will have improved production while others will have decreases. (International Hydropower Association (IHA))   | Removed hydropower from sentence.  |
| 216 | 69085 | 10 | 11        | 19        | 11      | 21      | This sentence implies that the potential and dependability of hydropower will be affected by increasing temperatures. However, no indication is provided elsewhere in the chapter that the effects of climate change on hydropower will be particularly driven by increasing temperatures. For instance, they may also relate to changes in precipitation levels. The sentence should be restated to reflect this. (NETHERLANDS)  | Removed hydropower from sentence.  |
| 217 | 71335 | 10 | 11        | 20        | 11      | 21      | The statement about hydropower is not consistent with the information provided earlier in this chapter (p.7, lines 19-23), which says that climate change impacts are likely to increase hydropower generation in most regions of the world (not decrease it, as stated in this sentence). (CANADA)   | Removed hydropower from sentence.  |
| 218 | 71336 | 10 | 11        | 21        | 11      | 22      | This sentence does not make sense as is. Suggest re-wording to say that climate change impacts on energy supply will probably be relatively small compared to the impacts on energy demand. (CANADA)  | Clarified  |
| 219 | 73053 | 10 | 11        | 22        | 0       | 0       | Reiterate that temperature changes are not the only meteorological change associated with climate change. Consequently, impact estimates based only on temperature are under-estimates. (UNITED STATES OF AMERICA)  | Clarified  |
| 220 | 73054 | 10 | 11        | 28        | 0       | 0       | The same effects on GDP that were previously called "moderate" in the report are called "relatively small" here. Skip the adjectives and just report the numbers. Also, note that a 1% decrease in GDP in the US is currently equivalent to \$150 billion a year. The "small" 1% is recognized as much larger when expressed as \$150 billion a year. (UNITED STATES OF AMERICA)  | deleted the phrase "relatively small" and instead referred to the actual numbers   |
| 221 | 71337 | 10 | 11        | 29        | 11      | 30      | Suggest giving consideration to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable |
| 222 | 82422 | 10 | 11        | 29        | 11      | 30      | The statements on these lines should be clarified. Does the described range pertain to the previous sentence? (Katharine Mach, IPCC WGII TSU)   | clarified.   |
| 223 | 71338 | 10 | 11        | 33        | 11      | 34      | It may be worth mentioning Scott et al. (2008), who did an attempt at measuring the adaptive benefits of energy efficiency programs in the US. Scott, M. J., Dirks, J. A., & Cort, K. A. (2008). The value of energy efficiency programs for US residential and commercial buildings in a warmer world. Mitigation and Adaptation Strategies for Global Change, 13(4), 307-339 (CANADA)   | The study mentioned, while interesting, is not part of a larger macroeconomic study, which was the point of the statement. Clarified the sentence accordingly.                   |
| 224 | 65936 | 10 | 11        | 49        | 14      | 49      | The section on the water sector seems to have no good geographical coverage. Most cited studies refer to a small set of cases. This should be improved. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Geographic detail is covered in the regional chapters  |
| 225 | 73055 | 10 | 12        | 1         | 12      | 1       | The title of 10.3.1. seems too broad. If changes are not made to expand this section to consider other impacts aside from floods and droughts, perhaps reword the title? (UNITED STATES OF AMERICA)   | Other sectors added.   |
| 226 | 59998 | 10 | 12        | 1         | 12      | 42      | Additional references to consider: Economic impacts of climate change especially drought in Syria: Breisinger, C, T Zhu, G Nelson, R Robertson, J Funes, D Verner, 2011, Global and local economic impacts of climate change in Syria and options for adaptation, IFPRI Discussion Paper 01091, June 2011, International Food Policy Research Institute and the World Bank, <a href="http://www.ifpri.org/sites/default/files/publications/ifpridp01091.pdf">http://www.ifpri.org/sites/default/files/publications/ifpridp01091.pdf</a> ; (AUSTRALIA) | Reference Added  |

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| 227 | 73056 | 10 | 12        | 1         | 14      | 50      | The section on water is not organized by the main components of the water system. This might be OK if the authors include an explanation for why it is not discussed this way. However, it may still make sense to go through the mental exercise of a component based framework to make sure nothing has been missed; in particular, different components of the water system would face very different risks from climate-related events. Also, there is no discussion of how water quality may be affected due to decreased water quantity and increased storms. (UNITED STATES OF AMERICA) | Addressed by change in title and revision to introduction. Also See Chapter 3 for comprehensive coverage of the water sector. WQ in Section 10.3.3  |
| 228 | 73057 | 10 | 12        | 1         | 14      | 50      | There is no sense from the water section of whether the studies available represent a limited or fully fleshed out picture of water related impacts. Are they robustly studied? Or limited by important data and information gaps? (UNITED STATES OF AMERICA)  | Addressed in Introduction   |
| 229 | 73058 | 10 | 12        | 1         | 14      | 50      | What about water demand issues? How will consumers respond to climate change? What major challenges do providers face? What if there is climate-induced migration? What would that mean for water resources? How might current conflicts over water rights and use be exacerbated given competing demands? What about the possible draw down of aquifers at a faster rate - what would be the implication? (UNITED STATES OF AMERICA)  | These issues are address specifically in other chaptes (eg Water Demand in Chapter 3) The impacts on the costs of providing additional infrastrucure to meet increaeased demand will be found here (eg irriigaton 10.3.6) |
| 230 | 73059 | 10 | 12        | 3         | 12      | 13      | If the trends discussed in the introductory paragraph to the water section are mostly driven by non-climate related events, then it seems inappropriate to emphasize them. (UNITED STATES OF AMERICA)  | They are discussed because mulitple stresses can push system over failure thresholds. Especially in Water System.   |
| 231 | 69086 | 10 | 12        | 3         | 12      | 42      | Write the time periods consistent. There are currently a lot of different ways how time periods are mentioned. E.g.: "1950-1980" (line 7), "1990 to 1996" (line 7), "1997/8" (line 18) and "2010-50" (line 42). Check also in the rest of the chapter. (NETHERLANDS)   | Addressed in text   |
| 232 | 73060 | 10 | 12        | 3         | 12      | 42      | Were hurricanes purposely excluded from this section? If not, shouldn't they also be considered a water-related extreme event and covered here? (UNITED STATES OF AMERICA)   | Address in the Coastal Chapter and Section 10.7   |
| 233 | 73061 | 10 | 12        | 4         | 12      | 11      | There might be some information on drought trends in World Bank (2012) that would be useful to add in this paragraph. World Bank. 2012. Turn Down the Heat: Why a 4 degree centigrade warmer world must be avoided. <a href="http://climatechange.worldbank.org/sites/default/files/Turn_Down_the_he...">http://climatechange.worldbank.org/sites/default/files/Turn_Down_the_he...</a> (UNITED STATES OF AMERICA)   | Noted Biophysical aspects are in Chapter 3  |
| 234 | 73062 | 10 | 12        | 6         | 12      | 6       | Isn't there a more recent study from Munich Re that could be cited here? (UNITED STATES OF AMERICA)  | None found  |
| 235 | 77791 | 10 | 12        | 10        | 12      | 12      | Fix both citation formats. (Christian Reuten, RWDI AIR Inc.)   | Addressed in text   |
| 236 | 77174 | 10 | 12        | 11        | 3       | 11      | events on water supply (IPCC, 2012) and (ITALY)  | Addressed in text   |
| 237 | 73063 | 10 | 12        | 14        | 12      | 18      | See also Hurd and Rouhi-Rad (2013) for other literature and new estimates that may be worth citing here or elsewhere in Water section. Hurd, B., and M. Rouhi-Rad. 2013. Estimating economic effects of changes in climate and water availability. Climatic Change 117(3): 575-584. (UNITED STATES OF AMERICA)   | Reference Added   |
| 238 | 73064 | 10 | 12        | 18        | 12      | 23      | Add a caveat that the effects of typical (baseline) hydrological variability should not be confused with climate change effects. (UNITED STATES OF AMERICA)  | Addressed in text   |
| 239 | 73065 | 10 | 12        | 18        | 12      | 29      | Are these total losses - due to climate change and other reasons - or only the portion attributable to climate change? The text should clearly state what it is reporting. (UNITED STATES OF AMERICA)  | Addressed in text   |
| 240 | 82423 | 10 | 12        | 28        | 12      | 28      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)  | Noted   |
| 241 | 69087 | 10 | 12        | 31        | 12      | 42      | Try to be consistent with currencies. If possible, convert everything in dollars. Also, same as with the time periods, try to be consistent with the style. Check also in the rest of the chapter. (NETHERLANDS)   | Noted- done for entire chapter  |
| 242 | 73066 | 10 | 12        | 31        | 12      | 42      | Estimates of the impact of climate change related flooding need to be paired with the assumptions on change in global mean temperature. (UNITED STATES OF AMERICA)   | Flooding damages are related to changes in local precipitation. The warmest global scenarios often do not lead to the largest local damages or the correlation of Global Delta T to flooding is very much GCM dependent.  |
| 243 | 73067 | 10 | 12        | 33        | 12      | 37      | Why is the high emission scenario the only one reported? What is the range? How do these values change under more moderate scenarios? (UNITED STATES OF AMERICA)   | Wobus, et al 2013 addresses this issue.   |

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|-----|-------|----|-----------|-----------|---------|---------|--|---|
| 244 | 79530 | 10 | 12        | 45        | 13      | 8       | There is no mention of the effect of rising temperatures on the demand for drinking water. Is this because no evidence - be it actual or biophysical exists or because the evidence that does exist suggests the effect will be marginal? The need for oral rehydration is referred to in the later health section (page 29 line 28). (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)   | At the scale addressed in chapter drinking water is extremely small, Potable water is less than 2% of all municipal water demand.   |
| 245 | 73068 | 10 | 12        | 47        | 13      | 18      | A list of study and region specific results is not all that helpful. What are the key take-aways from all of these studies? Are these values big or small? How should we interpret them? The use of tables like those in the energy supply section would be a more useful way to convey the level of detail available in specific studies, and allow the text to focus on the broader points one derives from these studies for understanding the types of adaptation that are needed and how they change with region and climate conditions. For example, are these effects driven by drought? Or an increased demand for water for energy or other uses? What role can water pricing play? What about other conservation policies? There may be lessons that can be learned from literature that isn't climate specific - for example, how changes in water supply to deal with extreme drought can help mitigate impacts.... (UNITED STATES OF AMERICA) | The range of impacts are so broad there are no general conclusion. Secondly this section reports on economics of impact and adaptation. The institutional and engineering aspects of adaptation are address in Chapter 3.             |
| 246 | 77792 | 10 | 12        | 52        | 12      | 53      | It does not seem right that municipal and industrial water supply "infrastructure has an economic and engineering life of less than 25 years". Please provide a citation or drop this statement. In fact, the sentence makes more sense if it stated "more than 25 years". (Christian Reuten, RWDI AIR Inc.)   | Addressed in text   |
| 247 | 71339 | 10 | 12        | 54        | 11      | 54      | Suggest giving consideration to including the \$ level impacts of a cost of 0.2 to 2.8% of the net present value. (CANADA)   | Addressed as part of Chapter-wide cost harmonization  |
| 248 | 71340 | 10 | 13        | 7         | 13      | 7       | Suggest giving consideration to including the \$ level cost associated with the 12% treatment cost increase and 22% rise in residential costs. (CANADA)  | Addressed as part of Chapter-wide cost harmonization  |
| 249 | 73069 | 10 | 13        | 10        | 13      | 18      | Not clear whether all of the estimates in this paragraph are from Ward et al. Also, the global average decrease in GDP should be supplemented with a discussion of the range for various countries or the temperate vs. tropics or developed country vs. developing country differences. (UNITED STATES OF AMERICA)  | Ward et al Addressed in text, This work is from a World Bank global assessment, lowest resolution is by World Bank Regions  |
| 250 | 71341 | 10 | 13        | 16        | 13      | 16      | Suggest giving consideration to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)  | Addressed as part of Chapter-wide cost harmonization  |
| 251 | 71342 | 10 | 13        | 18        | 13      | 18      | Suggest giving consideration to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)  | Addressed as part of Chapter-wide cost harmonization  |
| 252 | 71343 | 10 | 13        | 26        | 13      | 27      | The words "average over 17 climate models" are awkward and make this sentence difficult to read. Suggest revising. (CANADA)  | Addressed in text   |
| 253 | 73070 | 10 | 13        | 27        | 13      | 27      | Here and in some other places the A2 scenario is referenced. A brief description of the scenario, perhaps in a text box, would help readers understand the context of the study being described (realizing the scenarios may all be described in more detail elsewhere in the AR5). (UNITED STATES OF AMERICA)   | This is beyond the scope of this chapter and can be found in AR4 WG1 and AR5-WG1 reports.   |
| 254 | 71344 | 10 | 13        | 28        | 13      | 28      | Sentence is awkward and linkage with previous sentence is not fully clear. (CANADA)  | Addressed in text   |
| 255 | 73071 | 10 | 13        | 30        | 13      | 32      | The costs in those three US cities are "low" because a 10-year flood is not a very significant extreme weather event. USG water resources planning typically considers a 50-year flood. Also, note with the increasing severity and frequency of flooding associated with climate change, what used to be, for example, a 100-year flood may become a 50-year flood. (UNITED STATES OF AMERICA)  | Urban Stormwater does follow US FEMA 100-yr storm guidelines, it is a function of importance of the road and volume of traffic. In many cases it is the 10 yr event. The nature of extreme hydrologic events is covered in Chapter 3. |
| 256 | 77793 | 10 | 13        | 32        | 13      | 33      | Why are bridges mentioned in this section? (Christian Reuten, RWDI AIR Inc.)   | There are bridges in urban regions and urban drainage/stormwater management is important part of their design.  |
| 257 | 78185 | 10 | 13        | 36        | 0       | 0       | In chapter 27, page 37 lines 16 to 20 there is a reference for hydropower and alternative energy sources that could be mentioned here (Lucena et al 2010a). (Christiano de Campos, Petroleo Brasileiro SA)   | Thank you. Noted.   |
| 258 | 84615 | 10 | 13        | 36        | 0       | 0       | Section 10.3.4: It would be worth considering moving this material to section 10.2, given its relevance to the discussion there and the associated findings in the ES. (Michael Mastrandrea, IPCC WGII TSU)  | Sections has been moved to Section 2  |
| 259 | 65937 | 10 | 13        | 36        | 13      | 48      | The section on hydropower and cooling water should be merged with the similar section on energy supply (p 6   24-47). (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Sections has been moved to Section 2  |
| 260 | 73072 | 10 | 13        | 38        | 13      | 48      | This section needs a few general sentences explaining how these impacts could play out - through what mechanisms - before any discussion of specific studies. Otherwise, there is no context in which to interpret them. (UNITED STATES OF AMERICA)  | Sections has been moved to Section 2 where this comment is addressed in context   |

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| 261 | 82424 | 10 | 13        | 47        | 13      | 48      | The author team should ensure there is a probabilistic basis for these likelihood assignments. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)  | Noted - Now Section 10-2   |
| 262 | 73073 | 10 | 13        | 51        | 13      | 53      | Delete since nothing is here. Sections with no content are not needed, particularly when they just refer to other sections in the same chapter. (UNITED STATES OF AMERICA)   | Noted: CLAs will address in final comprehensive edit of Chapter 10.  |
| 263 | 77794 | 10 | 14        | 4         | 14      | 5       | Maybe add an explanation how changes in precipitation and temperature affect irrigation. Both patterns and amounts of precipitation play a role, more not necessarily decreasing irrigation demand. Temperature plays a role both for soil drying and for evaporation in case of above surface irrigation. (Christian Reuten, RWDI AIR Inc.)   | Not in Scope of this Chapter - See Chapter 3.  |
| 264 | 73074 | 10 | 14        | 4         | 14      | 13      | This seems focused on water demand impacts for irrigation. Is there any literature on the supply side? If covered elsewhere then please refer the reader to the relevant ch, section. (UNITED STATES OF AMERICA)   | Addressed in text  |
| 265 | 73075 | 10 | 14        | 6         | 14      | 6       | The authors should confirm that cross-referenced chapters contain the promised materials. For example, the chapter claims that chapter 19 discusses economy-wide impacts so they are not covered here. This does not appear to be the case. Perhaps the authors should include a section summarizing the literature on economywide impacts of climate change. Also, why is this point made in the section on irrigation? (UNITED STATES OF AMERICA)  | Text removed.  |
| 266 | 73076 | 10 | 14        | 8         | 0       | 0       | Maintaining existing irrigated area will not be adequate to meet increasing food demand from income and population increases and changes in diet composition over the period. (UNITED STATES OF AMERICA)   | Addressed in text and Noted. Scenarios of geographically explicit and economically based irrigation expansion are rare. IPFRI (Nelson, et al 2009) does include increased irrigated area based on historic growth rates. |
| 267 | 77795 | 10 | 14        | 10        | 14      | 11      | The phrase "soil water management from increased irrigated and drained areas" is not clear. (Christian Reuten, RWDI AIR Inc.)  | Addressed in text  |
| 268 | 73077 | 10 | 14        | 16        | 14      | 27      | These two sub-sections are very weak. If there is not a body of literature to make these more substantive, then the authors should consider deleting them. Is nature conservation an economic sector? If there is no information on nature conservation as an economic sector in the water context (there is a lot of literature about nature conservation in the context of climate change generally, I think, but this would be an expansion of the chapter) then delete this section or combine with the ecosystem services section. (UNITED STATES OF AMERICA)   | Sections are included for completeness.  |
| 269 | 65938 | 10 | 14        | 30        | 14      | 40      | There should be much more literature on water management and water use conflicts being cited, and brought into relation to adaptatoin to climate change more explicitly. Examples for literature (there must me much more): Fisher, A. C. & Rubio, S. J. (1997) Adjusting to Climate Change: Implications of Increased Variability and Asymmetric Adjustment Costs for Investment in Water Reserves, Journal of Environmental Economics and Management, 34, 207-227. Stillwell, A. S.; King, C. W.; Webber, M. E.; Duncan, I. J. & Hardberger, A. (2011) The Energy-Water Nexus in Texas, Ecology and Society, 16, Art. 2. Charlton, M. B. & Arnell, N. W. (2011) Adapting to climate change impacts on water resources in England - An assessment of draft Water Resources Management Plans, Global Environmental Change, 21, 238-248. Crabbe, P. & Robin, M. (2006) Institutional Adaptation of Water Resource Infrastructures to Climate Change in Eastern Ontario, Climatic Change, 78, 103-133. Huntjens, P.; Lebel, L.; Pahl-Wostl, C.; Schulze, R.; Camkin, J. & Kranz, N. (2012) Institutional design propositions for the governance of adaptation to climate change in the water sector, Global Environmental Change, 22, 67-81. Nassopoulos, H.; Dumas, P. & Hallegatte, S. (2012) Adaptation to an uncertain climate change: cost benefit analysis and robust decision making for dam dimensioning, Climatic Change, 114, 497-508. Eisenack, K. & Stecker, R. (2012) A framework for analyzing climate change adaptations as actions, Mitigation and Adaptation Strategies for Global Change, 17, 243-260. Ruth, M.; Bernier, C.; Jollands, N. & Golubiewski, N. (2007) Adaptation of urban water supply infrastructure to impacts from climate and socioeconomic changes: The case of Hamilton, New Zealand, Water Resources Management, 21, 1031-1045. (Klaus Eisenack, Carl von Ossietzky University Oldenburg) | This is not in the scope of this chapter but is directed to Chapter 3.   |
| 270 | 73078 | 10 | 14        | 39        | 14      | 40      | Is the Strzepek study only US impacts - do we know anything about impacts elsewhere or are other regions not well studied? (UNITED STATES OF AMERICA)  | Addressed in Text  |
| 271 | 65940 | 10 | 14        | 43        | 14      | 49      | It should be mentioned that the effects of water scarcity can be quite severe in some areas of the world. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | This is addressed in Chapter 3.  |

| #   | ID    | Ch | From Page | From Line | To Page | To Line | Comment   | Response   |
|-----|-------|----|-----------|-----------|---------|---------|---|--|
| 272 | 57617 | 10 | 14        | 45        | 14      | 49      | In line49, it is suggested to adding "globally the overall impacts of climate change on water resources, and through these on socio-economic system are negative" Reference: (1) IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp. (2) Wu Shaohong, Yin Yunhe. Impacts of Climate Extremes on Human Systems. Advances in Climate Change Research. 2012,8,99-102 (In Chinese) (3) Claudia Sadoff and Mike Muller.2009. Water Management, Water Security and Climate Change Adaptation: Early Impacts and Essential Responses. the Global Water Partnership. 85pp. (Cao Jianting, GIWP, Ministry of Water Resources, China) | Author stands by the summary statement which does require a citation as it is drawn from citation in the entirety of Section 10.3, SREX is cited and the other citations are more appropriated for Chapter 3 |
| 273 | 65939 | 10 | 14        | 46        | 14      | 48      | We cannot distinguish yet wether the residual damage costs (here imprecisely termed 'costs in terms of impacts') or the adaptation costs dominate. I know of little studies that precisely disentangle both cost categories, and they do not come up with a generalizable conclusions. I expect that it strongly depends on the geographical conditions which costs dominate. So, be more modest with the statement that adaptation costs are relatively modest. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | World Bank EACC (Ward, et al, 2010) does address residual damages. Comment Addressed in the text.  |
| 274 | 67868 | 10 | 15        | 0         | 0       | 0       | Section 10.4. is better to include some description on Northern/Arctic Sea Route. (JAPAN)   | Chapter has been reviewed & restructured.  |
| 275 | 65944 | 10 | 15        | 1         | 15      | 15      | Current stakeholder-driven research on adaptation in the transport sector frequently shows the following crucial strategies: adjustment of technical norms, regulation of infrastructure (does it set the right incentives?), liability for disruptions, planning the timing of re-investments (life time of long-lived assets, postponing decisions in light of uncertainty, retrofitting and flexibility). There is, however, parctically no peer-reviewed literature on this. It will be worth mentioning this a crucial research gaps. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Out of scope and there is not directly relevant studies currently published - an area for future research  |
| 276 | 77175 | 10 | 15        | 1         | 16      | 2       | In the event of extreme weather events infrastructure such as power grids and water, roads and railways are essential for rescue operations, and experience an increase in demand, but are also the object of aggression by climatic events. Therefore, the cumulative effects that are generated are not only produced by meteorological events and the response of land and infrastructure, but also by changes in the human use generated by the events themselves. (ITALY)  | Text revised   |
| 277 | 65941 | 10 | 15        | 1         | 16      | 51      | The whole transport section lacks information about adaptation in relation to impacts. Please increase coverage on adaptation. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Text revised   |
| 278 | 73079 | 10 | 15        | 1         | 16      | 51      | The focus here is on transportation infrastructure, but is there any information available on whether climate change will also result in additional wear and tear on autos, trucks, planes, etc? (UNITED STATES OF AMERICA)   | Out of scope and there is not directly relevant studies currently published - an area for future research  |
| 279 | 65942 | 10 | 15        | 7         | 15      | 7       | The term „Vulnerability“ in the headline is imprecise. Call it „major stimuli“. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Text revised   |
| 280 | 63567 | 10 | 15        | 7         | 15      | 10      | The second column in this table does not contain information on vulnerabilities. Suggestion: Replace column head ("Vulnerabilities to Changes in Climate") by "Affected by climate change through". (GERMANY)   | Text revised   |
| 281 | 82425 | 10 | 15        | 7         | 15      | 10      | The logic and parallelism of examples in the "vulnerabilities" column could be considered. For line 8, should the entry begin with "changes in permafrost"? Additionally, are the examples more nearly "changes in climate with associated vulnerabilities"? Could this be clarified? (Katharine Mach, IPCC WGII TSU)   | Text revised   |
| 282 | 65945 | 10 | 15        | 8         | 15      | 10      | The list of stimuli (here imprecisely called „Vulnerabilities“) should be extended by flooding and heat waves. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | Text revised   |
| 283 | 73080 | 10 | 15        | 8         | 15      | 10      | Consider adding other vulnerabilities: 1) Coastal storms (including hurricanes, taiphoons, Nor'easters in the US) exacerbated by SLR, and 2) local SLR. (Alluded to in line 41, these affect all transportation modes in coastal areas). (UNITED STATES OF AMERICA)   | Text revised   |
| 284 | 84616 | 10 | 15        | 8         | 15      | 10      | Are "changes in" permafrost freeze-thaw cycles and precipitation intensity meant in line 8? (Michael Mastrandrea, IPCC WGII TSU)  | Text revised   |



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|-----|-------|----|-----------|-----------|---------|---------|---|--|
| 285 | 65943 | 10 | 15        | 12        | 15      | 15      | There are more important publications that give a good overview on adaptation and impacts for all/most transport modes and for some regions / the whole literature. They show, in particular, that many technological adaptation options are available, but the knowledge on incentives, institutions and governance of these is still rather limited. Such publications should be cited. Eisenack, K.; Stecker, R.; Reckien, D. & Hoffmann, E. (2012) Adaptation to climate change in the transport sector: a review of actions and actors, Mitigation and Adaptation Strategies for Global Change, 17, 451-469. Savonis, M. J.; Burkett, V. R. & Potter, J. R. (ed.) (2008) Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I, Department of Transportation, USA. Kirshen P, Knee K, Ruth M (2008) Climate change and coastal flooding in Metro Boston: impacts and adaptation strategies, Clim Chang, 90:453–473. Kirshen P, Ruth M, Anderson W (2008b) Interdependencies of urban climate change impacts and adaptation strategies: a case study of Metropolitan Boston USA, Clim Chang 86:105–122. Koetse, M. J. & Rietveld, P. (2009) The impact of climate change and weather on transport: An overview of empirical findings, Transportation Research Part D: Transport and Environment, 14, 205-221. (Klaus Eisenack, Carl von Ossietzky University Oldenburg) | suggested references reviewed and added where relevant |
| 286 | 78186 | 10 | 15        | 18        | 0       | 0       | Unpaved roads in sugar cane plantations are vulnerable to extreme precipitation disabling the harvest during the event, loosing the some yield and delaying the plant to produce ethanol. (Christiano de Campos, Petroleo Brasileiro SA)  | Text revised   |
| 287 | 73081 | 10 | 15        | 18        | 15      | 36      | Why is there no discussion of the impact on bridges? Risk of flood damage or sea level rise may mean having to build bridges that are higher, or high winds and large storms may require more reinforced bridges, both of which have cost implications. Please add relevant literature on bridge impacts to this section. (UNITED STATES OF AMERICA)  | Addressed in the text.                                 |
| 288 | 73082 | 10 | 15        | 20        | 15      | 23      | Another reference is the Gulf Coast study (US), which discusses miles of highways and other transportation facilities affected under different scenarios (Phase 1, completed in 2008), and LSLR, storm scenarios (Phase 2, see pages 137 and 193). <a href="http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_an...">http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_an...</a> (UNITED STATES OF AMERICA)   | reference added to suggested sections                  |
| 289 | 73083 | 10 | 15        | 20        | 15      | 23      | Can more be said about the findings of these studies, especially the quantitative ones (MacArthur et al. 2012, Nemry and Nemirel 2012)? (UNITED STATES OF AMERICA)  | Text revised   |
| 290 | 57612 | 10 | 15        | 25        | 15      | 30      | the segment lacks the influence of climate change from the perspective of the transport sector.for the transport sector, they pay more attention to the indirect influence of climate change. I suggest to add the content "Changes in precipitation and temperature may increase the frequency and costs of road maintenance."after line 25 and add the content "Heavy precipitation will threaten the driving safety of vehicles and raise the transport safety management costs."after line 27 and add the content "Floods will affect the efficiency of urban transport system as well as driving safety." the references relate to the above suggestions: (1) Peter H. Larsen, Scott Goldsmith, Orson Smith, Meghan L. Wilson, Ken Strzepek, Paul Chinowsky, Ben Saylor. Estimating future costs for Alaska public infrastructure at risk from climate change [J]. Global Environmental Change, 2008, 18(3): 442-457. (2) Daniel Eisenberg. The mixed effects of precipitation on traffic crashes [J].Accident Analysis & Prevention, 2004, 36(4):637-647. (Bo Liu, National climate center)   | Text revised   |
| 291 | 64350 | 10 | 15        | 30        | 0       | 0       | The correct publications year for the Lemmen and Warren reference is 2004. An alternative and more recent reference from Canada that supports these same points would be Chiotti, Q. and Lavender, B. (2008): Ontario; in From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by D.S. Lemmen, F.J.Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 227-274. See Case Study 3 of that paper, p. 246. (Don Lemmen, Canada National Study)   | Text revised   |
| 292 | 69088 | 10 | 15        | 33        | 15      | 34      | The vulnerability of unpaved roads to intense precipitation seems logical, but no reference is provided. This statement would be stronger with a reference. This is particular important since the vulnerability of unpaved roads to intense precipitation is restated in the TS. (NETHERLANDS)   | Text revised   |
| 293 | 73084 | 10 | 15        | 36        | 0       | 0       | Discussion on unpaved roads only focuses on cold climates. Flood impacts on unpaved roads in the tropics may be far more significant due to the much greater number of people potentially affected. (UNITED STATES OF AMERICA)  | Text revised   |
| 294 | 65946 | 10 | 15        | 39        | 15      | 47      | A further impact is flooding / erosion / subsidence of rail track. Another one disruptions due to storms such that vegetation debris blocks rail track. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Text revised   |
| 295 | 65947 | 10 | 15        | 39        | 15      | 47      | Please add adaptation measures, e.g. improved drainage of rail track, changes in materials used, adjusted technical standards, adjusted liability rules for delays, adjusted rail regulation. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Addressed in the text. Cited a reference document      |

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|-----|-------|----|-----------|-----------|---------|---------|---|---|
| 296 | 58264 | 10 | 15        | 41        | 15      | 47      | It is suggested to increase Chinese literature on the impact of climate change on permafrost. (See Qin Dahe et al., Evolution of Climate and Environment in China, 2012, Meteorological Press, Beijing, 2012) (Juqi Duan, National Climate Center, Chinese Meteorological Administration)   | References reviewed                           |
| 297 | 79531 | 10 | 15        | 42        | 15      | 42      | verify the URS 2010 reference is relevant here since the text of the report for UK government doesn't appear to mention permafrost. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | References reviewed                           |
| 298 | 73085 | 10 | 15        | 42        | 15      | 51      | Are there any studies looking at air travel impacts in colder permafrost regions? Are the impacts similar to lower latitudes? (UNITED STATES OF AMERICA)  | Noted. Re-reviewed literature                 |
| 299 | 73086 | 10 | 15        | 43        | 15      | 44      | The discussion gives a slightly misleading impression of the nature of the threat that heat poses to rails. While increased temperatures will cause expansion of continuously welded steel rails, whether this is an operational issue or not depends on whether sustained temperatures exceed design temperature thresholds. Rails are periodically replaced on a multi-decade cycle, so that design specs can creep upward. However, greater variability of temperatures pose a more difficult problem, since rails that are designed for high temperatures may then shrink at lower temperatures, and vice-versa. Uncertainty about future temperatures poses a problem in setting design specs for new rails. Flooding and extreme precipitation poses a hazard to rail bridges and rights of way. (UNITED STATES OF AMERICA)   | Text revised                                  |
| 300 | 73087 | 10 | 15        | 47        | 0       | 0       | There is no mention of rail or urban transport systems in the tropics. (UNITED STATES OF AMERICA)   | Out of scope                                  |
| 301 | 78187 | 10 | 15        | 50        | 0       | 0       | Extreme precipitation followed by land slides can affect pipelines in tropical countries. (Christiano de Campos, Petroleo Brasileiro SA)  | Text revised                                  |
| 302 | 84617 | 10 | 15        | 50        | 0       | 0       | Section 10.4.3: It would be worth considering moving this material to section 10.2, given its relevance to the discussion there and the associated findings in the ES. (Michael Mastrandrea, IPCC WGII TSU)   | Chapter has been reviewed & restructured.     |
| 303 | 65948 | 10 | 15        | 50        | 16      | 2       | Are you knowledgeable of publications about the potential for retrofit of pipelines? If so, please add. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | Outside scope of text                         |
| 304 | 63568 | 10 | 16        | 5         | 0       | 0       | Many available adaptation measures are missing. You may consider to add the following publication: PIANC (2008): Climate Change and Navigation. EnviCom - Task Group 3. Available online: <a href="http://www.pianc.org/downloads/climate%20change/envicom-free-tg3.pdf">http://www.pianc.org/downloads/climate%20change/envicom-free-tg3.pdf</a> (GERMANY)   | Adaptation is covered elsewhere in the report |
| 305 | 63569 | 10 | 16        | 5         | 0       | 0       | Section title "Shipping". Perhaps better "navigation". (GERMANY)  | Titles were pre-determined, not by authors    |
| 306 | 63570 | 10 | 16        | 5         | 0       | 0       | The structure of this chapter could be improved. Suggestion: Paragraph 1 inland navigation; paragraph 2 maritime/"Great Lake" navigation; paragraph 3: economic effects (losses/gains). Paragraphs 1 and 2 could be structured giving (a) the most important climate variables and (b) the current knowledge about observed/projected climate impacts. (GERMANY)  | Chapter has been reviewed & restructured.     |
| 307 | 73088 | 10 | 16        | 5         | 16      | 5       | Check with other researchers (WG1?) about potential changes in ocean currents. Such changes could affect the speed, cost and GHGs associated with shipping as well as routing options. (UNITED STATES OF AMERICA)   | Out of scope                                  |
| 308 | 61231 | 10 | 16        | 5         | 16      | 37      | International shipping carries 90% of world trade. Therefore this section should be divided into two subsections: inland and coastal navigation and international shipping (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | space limitations prohibit break out detail   |
| 309 | 73089 | 10 | 16        | 7         | 16      | 7       | This section should include a discussion of Arctic shipping, drawing on the work, inter alia, of the Arctic Council. (UNITED STATES OF AMERICA)   | References reviewed                           |
| 310 | 63571 | 10 | 16        | 7         | 16      | 8       | Climate change affects inland waterway transport (IWT) not only through high and low flows, but also through changes in river ice, wind, and fog. Some effects may change to the advantage of IWT (e.g. reduced river ice occurrence), while others may change to the disadvantage (e.g. low flow on some rivers at the end of the 21st century). This information is scattered over the section. Please add a separate section on that. (see also comment on chapter 10, page 16, line 5 ff.) (GERMANY)  | space limitations prohibit break out detail   |
| 311 | 73090 | 10 | 16        | 7         | 16      | 8       | Section 10.4.2 (shipping) would benefit from a slightly more detailed discussion of how water levels affect inland shipping. Projections of future water levels are scenario and model dependent, and offer long-term averages. Even if average water levels remain unchanged, greater variability of water levels presents threats at both ends of the spectrum: high water levels threaten to damage fixed infrastructure and interrupt transport (since barges may not be able to fit under bridges and flooding creates hazards to navigation); while low water levels, cause interruptions through reduced navigability. Greater uncertainty about water levels inhibits investment by introducing an unquantified risk of damage or interruption into what are already very expensive investments. (UNITED STATES OF AMERICA) | section 10.4.4                                |
| 312 | 69089 | 10 | 16        | 10        | 16      | 10      | A reference should be inserted to support the statement that "increased frequency of flood periods will stop ship traffic on the Rhine more often". (NETHERLANDS)   | Reference added                               |

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|-----|-------|----|-----------|-----------|---------|---------|---|--|
| 313 | 63572 | 10 | 16        | 10        | 16      | 14      | The study by Middelkoop et al. (2001) can not be regarded as "current project". Consider using more recent literature as given below. Studies (1) and (2) focus on the Rhine River, (3) on the Rhine-Main-Danube corridor. Studies (2) and (3) are based on an current ensemble of climate projections: (1) Jonkeren et al. (referenced in chapter 23) (2) Holtmann B., Scholten, A., Baumhauer, R., Rothstein, B., Gründer, D., Renner, V., Nilson, E. (2012): Analyses of the Impact of Climate Change on Inland Waterway Transport and Industry on the Rhine. Weißensee Verlag. Bonn. 60-65. Available online: <a href="http://www.bmvbs.de/cae/servlet/contentblob/100384/publicationFile/69428/kliwas-second-status-conference.pdf">http://www.bmvbs.de/cae/servlet/contentblob/100384/publicationFile/69428/kliwas-second-status-conference.pdf</a> (3) Nilson, E., Lingemann, I., Klein, B., Krahe, P. (2012): Impact of Hydrological Change on Navigation Conditions. ECCONET report 1.4. Available online: <a href="http://www.econet.eu/deliverables/ECCONET_D1.4_final.pdf">http://www.econet.eu/deliverables/ECCONET_D1.4_final.pdf</a> (GERMANY) | Text revised   |
| 314 | 73091 | 10 | 16        | 10        | 16      | 20      | The text should make clear that these are just examples of the types of effects that may occur. It would also be useful to add whether other studies of this type exist for other major ports or if there are gaps in our understanding. (UNITED STATES OF AMERICA)   | Text revised   |
| 315 | 73092 | 10 | 16        | 13        | 0       | 0       | The statement that economic impacts "could be substantial" is vague. Are there any quantified estimates? (UNITED STATES OF AMERICA)   | See chapter 23 for more economic detail (noted in text line 14)                              |
| 316 | 73093 | 10 | 16        | 16        | 16      | 20      | The state of future water levels on the Great Lakes under conditions of climate change is uncertain, since the lakes are partly a managed system and the actual water level is a complicated function of precipitation, run-off, water management decisions, and evaporation. Models disagree on whether regional precipitation in the Midwest will rise or fall, and run-off is not a simple function of precipitation. One recent study looked at a range of scenarios, and found that water levels declined in about two-thirds of the scenarios, and increased in about one-third. (Kunkel & Angel, 2010). Water levels have tended to be low in recent decades, so an extrapolation of recent historical experience suggests lower water levels. The modeling results, however, are more ambiguous. Falling water levels can be ameliorated at some cost by increased dredging. (UNITED STATES OF AMERICA)   | Text revised   |
| 317 | 73094 | 10 | 16        | 18        | 16      | 19      | Was more moderate climate change defined in this study? Replace "between" with "across". (UNITED STATES OF AMERICA)   | Text revised   |
| 318 | 64351 | 10 | 16        | 22        | 16      | 23      | As lead author of the referenced publication (note correct publication year is 2004) I am uncomfortable having confidence statements associated with our findings. The sentence should be elevated to the previous paragraph as the focus of inland shipping in that paper is placed on the Great Lakes - St. Lawrence Seaway. Finally, revise second part of statement to state that (in the case of the Great Lakes) the declining water levels are primarily related to increased evaporation (not decreased runoff). Lemmen and Warren (2004, p.140) state "Virtually all scenarios of future climate change project reduced Great Lakes water levels and connecting channel flows, mainly because of increased evaporation resulting from higher temperatures". A more complete discussion is presented in Case Study 1 (p. 242) of Chiotti and Lavender (2008) - complete reference provide in an earlier comment. (Don Lemmen, Canada National Study)  | Text revised   |
| 319 | 73095 | 10 | 16        | 22        | 16      | 23      | Can the authors be more specific about the types of adaptation practices do the authors have in mind here? Is there a study that can be cited here? (UNITED STATES OF AMERICA)  | Out of scope / adaptation is not addressed   |
| 320 | 73096 | 10 | 16        | 23        | 16      | 15      | Are there any quantified impacts in any of these studies that could be mentioned here? Also, it might be good to note that some caution against being too optimistic about the ease of navigation in these regions due to hazardous conditions induced by the sea ice loss (e.g., Wilson et al. 2004, Stewart et al. 2007). Wilson, Katherina J., John Falkingham, Humfrey Melling, and Roger A. de Abreu. 2004. Shipping in the Canadian Arctic: Other Possible Climate Change Scenarios. International Geoscience and Remote Sensing Symposium, 2004. IGARSS 04. Proceedings. IEEE International, vol. 3, pp. 1853-56. Stewart, E.J., S.E.L. Howell, D. Draper, J. Yackel and A. Tivy. 2007. Sea Ice in Canada's Arctic: Implications for Cruise Tourism. Arctic 60(4): 370-380. (UNITED STATES OF AMERICA)   | Studies do not quantify impacts. references added where relevant about optimism and ice loss |
| 321 | 73097 | 10 | 16        | 24        | 0       | 0       | Replace "positively impact" with "increase" since this is a negative for the economy. (UNITED STATES OF AMERICA)  | Text revised   |
| 322 | 73098 | 10 | 16        | 26        | 16      | 26      | The report misses the fairly important idea that to the extent that climate affects agriculture or the location of economic activity generally, there will be secondary effects on freight transportation through changes in product flows. In particular, the work of Attavanich (2011), integrated modeling of climate, agriculture, transportation. Attavanich's work suggests that climate change will move the corn/wheat belt in the United States northward, and away from the Mississippi/Ohio/Mississippi River network, inducing a shift in agricultural product flows from down the Mississippi by barge to West by rail to the Pacific and East across the Great Lakes to the Atlantic. (UNITED STATES OF AMERICA)  | Out of scope   |

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|-----|-------|----|-----------|-----------|---------|---------|--|---|
| 323 | 73099 | 10 | 16        | 27        | 16      | 30      | What assets -- does this mean port infrastructure or all assets in port cities? Is \$3 trillion in assets big or small? What is the total value of these assets? (UNITED STATES OF AMERICA)  | Text revised  |
| 324 | 77796 | 10 | 16        | 28        | 16      | 28      | Reference 'Nursey-Bray and Miller 2012' not found in reference list. (Christian Reuten, RWDI AIR Inc.)   | Reference added   |
| 325 | 77797 | 10 | 16        | 28        | 16      | 28      | Reference 'Nicholls, R. J. et al., 2008' not found in reference list. (Christian Reuten, RWDI AIR Inc.)  | Reference added   |
| 326 | 61232 | 10 | 16        | 32        | 16      | 37      | Please quantify the cost increase here (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | References reviewed   |
| 327 | 63573 | 10 | 16        | 40        | 0       | 0       | I would have expected to read something about shifts in atmospheric circulation patterns (jet stream etc.) here. Possible literature: Williams, P.D. & M.M. Joshi (2013): Intensification of winter transatlantic aviation turbulence in response to climate change. Nature Climate Change. doi:10.1038/nclimate1866<br><a href="http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1866.html">http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1866.html</a> (GERMANY)  | Out of scope. Covered in WGI                                  |
| 328 | 73100 | 10 | 16        | 40        | 16      | 41      | This section ought to mention impact of sea-level rise/storm surge and flooding on airports. Airports are often built on reclaimed land close to sea level, or on flood plains. Consequently, many large international airports are at risk for sea-level rise and storm surge, fresh water flooding, or both At least a dozen major U.S. airports including SFO, OAK, JFK, BOS, and LGA are at elevations of less than 20 ASL. JFK is the busiest airport in the United States. In some cases risks to nearby airports are highly correlated (SFO & OAK, for instance), which would raise the cost of an event. (UNITED STATES OF AMERICA)                    | Text revised  |
| 329 | 61233 | 10 | 16        | 40        | 16      | 51      | Section 10.4.5. This section could also include a reference to the recent paper on increasing turbulences<br><a href="http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1866.html">http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1866.html</a> (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | References reviewed   |
| 330 | 65949 | 10 | 16        | 40        | 16      | 51      | Please add another impact: Precipitation runoff from extreme events can block runways. Mention also improved drainage as one adaptation option (that is quite expensive in the retrofit, but cheap when new runways are built). (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | noted--adaptation actions covered elsewhere                   |
| 331 | 65950 | 10 | 16        | 40        | 16      | 51      | A further adaptation option are adjusted liabilities for delays to set the adaptation incentives of airport operators, and adjusted regulation of airport charges. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)   | noted--adaptation actions covered elsewhere                   |
| 332 | 73101 | 10 | 16        | 42        | 16      | 44      | This blanket statement is not entirely accurate, though it would seem so at first. Stronger engines, and or lighter planes, too, can counter the effect of higher air temperatures on takeoff distance requirements. (UNITED STATES OF AMERICA)  | Text revised  |
| 333 | 64352 | 10 | 16        | 46        | 0       | 0       | The correct publications year for the Lemmen and Warren reference is 2004. (Don Lemmen, Canada National Study)   | Corrected   |
| 334 | 63463 | 10 | 16        | 47        | 16      | 47      | In 2010 the European Organisation for Safety of Air Navigation reported that there are a number of european airports at risk of inundation as a result of future sea-level rise (Eurocontrol, 2010). Source:<br><a href="http://www.eurocontrol.int/sites/default/files/content/documents/official-documents/facts-and-figures/statfor/challenges-of-growth-climate-adaptation-march-2010.pdf">http://www.eurocontrol.int/sites/default/files/content/documents/official-documents/facts-and-figures/statfor/challenges-of-growth-climate-adaptation-march-2010.pdf</a> (Diogo de Gusmao, Met Office Hadley Centre)  | Text revised  |
| 335 | 73102 | 10 | 16        | 49        | 16      | 51      | This discussion of pavement is slightly misleading. Pavements can be formulated to withstand very high temperatures, as runways in the Arabian Peninsula demonstrate. However, airports that are designed for moderate temperatures but experience high temperatures may have problems. As temperatures creep upward, airports are likely to be resurfaced over time with pavements specified for higher temperatures. Greater variability of temperatures or uncertainty about future temperatures make choosing a correct temperature specification more difficult, and may raise the risk of picking the wrong spec. (UNITED STATES OF AMERICA)             | covered in Pejovic, et al, 2009                               |
| 336 | 59017 | 10 | 17        | 16        | 17      | 17      | The main results of crop, forestry and freshwater ecosystems are not included here. Line 16-17 should adopt the results of chapter 7; line 22-29 and 34-37 should adopt the results of chapter 4. (Xiao-Ling WANG, National Climate Center, China Meteorological Administration)   | Due to lack of space it is referred in the concerned chapters |
| 337 | 59999 | 10 | 17        | 16        | 17      | 17      | Section 10.5.1.1 seems incomplete. Information is required on the expected economic losses and benefits associated with climate change and adaptation responses. (AUSTRALIA)   | Due to lack of space it is referred in the concerned chapters |
| 338 | 73103 | 10 | 17        | 19        | 17      | 50      | The authors could note here that one potential reason these studies are rare is that the endpoints studied in the natural science literature on ocean acidification to date has not lined up well with economic endpoints of interest - see Hilmi et al. (2012). Hilmi, Nathalie, Denis Allemand, Sam Dupont, Alain Safa, Gunnar Haraldsson, Paulo A. L. D. Nunes, Chris Moore, Caroline Hattam, Stephanie Reynaud, Jason M. Hall-Spencer, Maoz Fine, Carol Turley, Ross Jeffree, James Orr, Philip L. Munday, Sarah R. Cooley. 2012. Towards improved socio-economic assessments of ocean acidification's impacts. Marine Biology. (UNITED STATES OF AMERICA) | Accepted, Reference given                                     |

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|-----|-------|----|-----------|-----------|---------|---------|---|---|
| 339 | 79532 | 10 | 17        | 20        | 17      | 29      | The section does not consider the effect of rising temperatures (and possibly drier conditions) on the fire risks to forests (such as in N America, Australia and southern Europe). Does no evidence exist on the effect of climate change on the fire risks (or has no modelling of future risks been undertaken)? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | Could not find published reviewed literature  |
| 340 | 69090 | 10 | 17        | 22        | 17      | 27      | Rather old references. Is it possible to add some newer published articles? (NETHERLANDS)   | Some new references are given                 |
| 341 | 60000 | 10 | 17        | 22        | 17      | 29      | Section 10.5.1.2 on Forestry and logging is incomplete and relies on old economic data. The potential economic losses and benefits associated with climate change and adaptation responses is increasingly being recognised however, the studies tend to be qualitative rather than quantitative. Information that is available includes: Hanewinkel, M, D A Cullman, M Schelhass, G Nabuurs, and N E Zimmermann, 2012, Climate change may cause severe loss in the economic value of European forest land, Nature Climate Change, 3, 203-207 which indicates a 14 to 50% loss in the economic value of European forest land by 2100 due to climate change. This section could also include a discussion of the economics associated with forest-dependent people (eg. Sonwa, D J, O.A. Somorin, C. Jum, M Y Bele, J N Nkem, 2012, Vulnerability, forest-related sectors and climate change adaptation in Cameroon, Forest Policy and Economics). (AUSTRALIA)   | Accepted, Reference given                     |
| 342 | 73104 | 10 | 17        | 22        | 17      | 29      | What about the economic impacts of large scale dieback? Have existing models of climate impacts of forests and forest management been applied to the examination of economic consequences of large-scale dieback of either the Amazon rainforest or boreal forests? Also, there is some more recent literature on forestry impacts that may be useful to include in this section. See Aaheim et al. (2011) for a thorough review of economic and ecological models that address impacts and adaptation to climate in the forest sector. Sohngen et al.'s (2010) general overview of potential climate change impacts on the forest sector in the short, medium, and long run highlights the need for fuller integration of ecological and economic models (which tend to work on different time and geographic scales, and neglect to take into account adaptation in examining ecological impacts) to better understand how forest ecosystems and markets may be affected by climate change. Also note that the importance of certain modeling improvements may vary by region. For example, since boreal regions are less managed and touched by human influence (Sohngen et al. 2010), detailed modeling of adaptation responses, timber market impacts, and interactions with agriculture may play a smaller role at least in the nearer term. Better modeling of changes in precipitation patterns (e.g., climate impacts on ENSO) may also be less important than in tropical rainforests. (UNITED STATES OF AMERICA) | Accepted, Reference given                     |
| 343 | 79957 | 10 | 17        | 22        | 17      | 29      | Is it really evident that timber prices will be reduced due to climate change? Increased CO2 concentration in the atmosphere may lead to increased timber production. However, according to the climate goals, fossil energy needs to be replaced with renewable (NORWAY)   | Cannot comment as literature is silent on it. |
| 344 | 85128 | 10 | 17        | 24        | 17      | 24      | Proposed to change "short-rotation plantation" to "short-rotation forest plantation" as it will reflect specifically to the sub title 10.5.1.2 - Forestry and Logging. Same comment goes to Technical Summary Report, Page 24, Line 19. (MALAYSIA)  | Accepted and modified accordingly             |
| 345 | 73105 | 10 | 17        | 24        | 17      | 27      | But are different types of trees differentially affected? Seems like this would be the case - an additional 1-2 sentences of explanation would help make this connection. (UNITED STATES OF AMERICA)  | Accepted and sentence added                   |
| 346 | 73106 | 10 | 17        | 39        | 17      | 47      | It is a little hard to figure out the implications of this for the commercial fishing industry. For example, what about the interaction between climate change and already existing trends in overfishing? It seems like climate change would exacerbate these trends and make it harder for these ecosystems to recover. (UNITED STATES OF AMERICA)  | References given                              |
| 347 | 82426 | 10 | 17        | 41        | 17      | 41      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)   | likely is replaced by expected                |
| 348 | 73108 | 10 | 17        | 49        | 0       | 0       | Give examples of the biological impacts of ocean acidification. The vague "range of impacts" is not useful to readers. (UNITED STATES OF AMERICA)   | Reference given                               |
| 349 | 73107 | 10 | 17        | 49        | 17      | 54      | Another early study of the impacts on global fisheries that could be cited here is Cooley and Doney (2009). Cooley, S. R., and S. C. Doney. 2009. Anticipating ocean acidification's economic consequences for commercial fisheries. Environmental Research Letters 4(2), <a href="http://iopscience.iop.org/1748-9326/4/2/024007">http://iopscience.iop.org/1748-9326/4/2/024007</a> . (UNITED STATES OF AMERICA)  | Accepted and reference given                  |
| 350 | 73109 | 10 | 17        | 50        | 17      | 51      | If Brander et al. (2012) is primarily about coral reef tourism impacts then it should be moved to the tourism section. (UNITED STATES OF AMERICA)   | Accepted and moved to the Section on Tourism  |
| 351 | 73110 | 10 | 17        | 52        | 0       | 0       | It would be helpful to briefly explain what is meant by the value transfer approach for the non-technical reader. (UNITED STATES OF AMERICA)  | Sentence removed                              |

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|-----|-------|----|-----------|-----------|---------|---------|--|---|
| 352 | 73112 | 10 | 17        | 54        | 0       | 0       | Is this estimate for acidification apart from the effects of increases in temperature or is it a combined effect? What was the global mean temperature or carbon dioxide emissions assumption behind this? (UNITED STATES OF AMERICA)  | It is combined and references are given for assumptions |
| 353 | 73111 | 10 | 17        | 54        | 17      | 54      | Is the \$100 billion cost estimate referring to an annual cost at the end of the century or a cumulative cost through the end of the century? (UNITED STATES OF AMERICA)   | It is cumulative cost                                   |
| 354 | 79533 | 10 | 17        | 54        | 17      | 54      | Is the \$100bn figure an annual figure? This needs clarifying. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | It is cumulative cost                                   |
| 355 | 60001 | 10 | 18        | 3         | 18      | 9       | Other papers that could be considered for this section: impact on the Greek mining sector of US\$800 million compared to estimated US\$312 million of adaptation costs - Damigos, D, 2012, Monetizing the impacts of climate change on the Greek mining sector, Mitigation and Adaptation Strategies in Global Change, 17: 865-878, DOI:10.1007/s11027-011-9349-z, <a href="http://link.springer.com/content/pdf/10.1007%2Fs11027-011-9349-z.pdf">http://link.springer.com/content/pdf/10.1007%2Fs11027-011-9349-z.pdf</a> ) (AUSTRALIA)   | Accepted and reference given                            |
| 356 | 69091 | 10 | 18        | 5         | 18      | 9       | Rather extreme conclusions regarding climate change for the mining and quarrying sector. However, only two articles are being referred to. Is it possible to add more references that support these statements? Or nuance it by mentioning that maybe other factors might influence the viability of mining operations (think of new R&D that might lower the costs?) (NETHERLANDS)  | second option opted                                     |
| 357 | 73113 | 10 | 18        | 5         | 18      | 9       | Add: Also see section 10.2.2. (UNITED STATES OF AMERICA)   | not required due to proximity                           |
| 358 | 73114 | 10 | 18        | 5         | 18      | 9       | This paragraph is rather vague. Can you report any specific examples/findings from one of these studies? (UNITED STATES OF AMERICA)  | due to lack of definite studies                         |
| 359 | 82427 | 10 | 18        | 5         | 18      | 39      | Use of "would" in statements on lines 5, 16, 32, and 39 is ambiguous. It implies that climate change is a hypothetical, whereas of course some climate change has already occurred, some is locked in due to inertia of the climate system and human systems, and some is contingent on development patterns and mitigation choices. Further clarity would be helpful in this discussion of future risks and potential impacts. (Katharine Mach, IPCC WGII TSU)  | would is replaced by will                               |
| 360 | 60002 | 10 | 18        | 6         | 18      | 9       | Amendments: An increase in climate-related hazards such as forest and bush fires, flooding, windstorm, and cyclones, affects the viability of mining operations leading to increased operating, transport and decommissioning costs (Smith, M H, 2012, Assessing climate change risks and opportunities for investors: oil and gas processing sector, Investor Group on Climate Change and Australian National University, Canberra, <a href="http://www.igcc.org.au/Resources/Documents/oil_gas_assessing_climate_change_risks_for_investors.pdf">http://www.igcc.org.au/Resources/Documents/oil_gas_assessing_climate_change_risks_for_investors.pdf</a> ; Damigos, D (2012), Monetizing the impacts of climate change on the Greek mining sector, Mitigation and Adaptation Strategies for Global Change, 17:865-878, <a href="http://link.springer.com/content/pdf/10.1007%2Fs11027-011-9349-z.pdf">http://link.springer.com/content/pdf/10.1007%2Fs11027-011-9349-z.pdf</a> ). For example, the lost production time for the mining sector due to the 2010-11 widespread flooding in Queensland, Australia resulting in losses in excess of \$5 billion to the Queensland state product (Sharma, V, S van de Graaff, B Loechel, DM Franks, 2013, Extractive resource development in a changing climate: learning the lessons from extreme weather events in Queensland, Australia, National Climate Change Adaptation Research Facility, Gold Coast, Queensland). (AUSTRALIA) | Published references are accepted and added             |
| 361 | 61230 | 10 | 18        | 12        | 18      | 46      | It would be interesting to see a discussion of the impacts of climate change on water-intensive industries. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | could not find any study                                |
| 362 | 59462 | 10 | 18        | 14        | 18      | 26      | Section 10.5.2.1 is very weak. Some notes/references on changes (positive or negative) in total sales of the most vulnerable sectors, as well as innovations that are promoted as a response to climate change have to be included. (Danae Diakoulaki, Chemical Engineering, NTUA, Greece) (GREECE)  | due to lack of many studies                             |
| 363 | 73115 | 10 | 18        | 14        | 18      | 26      | What are the implications of changes in reliability of energy supply for production? (UNITED STATES OF AMERICA)  | no studies  |
| 364 | 79534 | 10 | 18        | 14        | 18      | 26      | I have not seen the Appendix A referred to in line 26. Does this refer to the studies by Merissa Dell et al which suggest that rising temperatures can slow the rate of economic growth by, in part, reduced labour productivity? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)   | Appendix A table gives the classification of industries |
| 365 | 59018 | 10 | 18        | 16        | 18      | 26      | The impacts of climate change on production process are described so generally. Extreme events such as snow storm and flood can destroy production facilities, which will induce break off of production process. So, impacts of extreme events on enterprises' properties, insurance and maintenance costs should be addressed. "this means that prices and qualities of inputs are different" should be "this means climate change impact on costs and availability of raw materials". Reference: Private Sector Engagement in Adaptation to Climate Change, OECD, NO.39. (Xiao-Ling WANG, National Climate Center, China Meteorological Administration)   | no studies  |

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| 366 | 69092 | 10 | 18        | 16        | 18      | 26      | It feels that this subsection (10.5.2.1) only mentions labour intensive manufacturing. However, not all manufacturing is labour intensive. (NETHERLANDS)  | The language refers to the mechanism in which industries can be affected by climate change |
| 367 | 59019 | 10 | 18        | 17        | 18      | 17      | The two key points are cost and availability. So, "this means that prices and qualities of inputs are different" should be "this means climate change impact on costs and availability of raw materials". Reference: Private Sector Engagement in Adaptation to Climate Change, OECD,NO.39. (Xiao-Ling WANG, National Climate Center, China Meteorological Administration)  | reference to be added, but it is unpublished   |
| 368 | 57613 | 10 | 18        | 17        | 18      | 18      | change "production process" to "supply chain". Related reference:Private Sector Engagement in Adaptation to Climate Change, OECD,NO.39 (Bo Liu, National climate center)  | production process is replaced by supply chain   |
| 369 | 73116 | 10 | 18        | 19        | 18      | 20      | Does this projection of falling labor productivity account for technological change and evolving production processes over time? If so, that would be a potentially profound effect on economic growth. Suggest noting how broadly applicable (or not) the finding is. (UNITED STATES OF AMERICA)   | Clarified  |
| 370 | 73118 | 10 | 18        | 20        | 0       | 0       | Labor productivity may also be reduced by increased incidence of malaria and other vector-borne diseases or by nutritional effects from reduced crop production/higher food prices. (UNITED STATES OF AMERICA)  | Clarified  |
| 371 | 73117 | 10 | 18        | 20        | 18      | 20      | By manual labor, do you specifically outdoor manufacturing manual labor? If so, specify. (UNITED STATES OF AMERICA)   | Not clear in the literature  |
| 372 | 77176 | 10 | 18        | 20        | 18      | 20      | Remove the fullstop before the parenthesis (ITALY)  | done   |
| 373 | 73119 | 10 | 18        | 26        | 18      | 26      | If there are a few quantitative studies, can something be pulled from them to discuss in the text (or displayed in a table), rather than having it all relegated to the Appendix? Do any of the studies quantify potential shifts in the location of manufacturing activities that are particularly susceptible to climate conditions? If there are a few key studies, summarize or cite those results, but a full enumeration of every study's findings is not necessarily warranted. (UNITED STATES OF AMERICA)   | Clarified  |
| 374 | 59463 | 10 | 18        | 31        | 18      | 46      | Need to include some relevant references to substantiate various claims. (Costas Balaras, Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Greece) (GREECE)  | only few studies are available so much reference cannot be added                           |
| 375 | 69093 | 10 | 18        | 31        | 18      | 46      | Where are the references in this section? A lot of predictions for the future, but no references? Maybe possible useful references are: "Julia Hertin , Frans Berkhout , David Gann & James Barlow (2003): Climate change and the UK house building sector: perceptions, impacts and adaptive capacity, Building Research & Information, 31:3-4, 278-290" or "W. Neil Adger, Nigel W. Arnell, Emma L. Tompkins, Successful adaptation to climate change across scales, Global Environmental Change, Volume 15, Issue 2, July 2005, Pages 77-86, ISSN 0959-3780, 10.1016/j.gloenvcha.2004.12.005.". (NETHERLANDS)                      | First reference is added, second one is not relevant.                                      |
| 376 | 73120 | 10 | 18        | 31        | 18      | 46      | This paragraph is missing a clear articulation that the direction and magnitude of the effect on construction and housing costs will likely vary geographically. E.g., higher temps (and less snow) could lengthen the building season in some regions, whereas higher temps in already hot and humid regions could shorten the building hours. Cost impacts due to changing precipitation and storms patterns (magnitude, frequency, and/or variation) will vary as these changes are expected to vary by region as well. (UNITED STATES OF AMERICA)   | Sentence added   |
| 377 | 69094 | 10 | 18        | 36        | 18      | 46      | None of the statements in the second part of this paragraph are backed up by references. Suggest to provide some references here. For instance, the statement that climate change would result in increased failures of window seals, increased leaks in roofing materials and reduced lifespan of cladding materials should be supported by reference(s). (NETHERLANDS)  | Reference added  |
| 378 | 73121 | 10 | 18        | 45        | 0       | 0       | Air to air heat exchangers, heat recovery ventilators, and dehumidifiers are other technologies that may be useful in adapting indoor air quality. (UNITED STATES OF AMERICA)   | Sentence added   |
| 379 | 65411 | 10 | 18        | 49        | 18      | 49      | There are many places where it would be appropriate to cite Becken, S. and J.E. Hay, 2012: Climate Change and Tourism: From Policy to Practice. Routledge/Taylor and Francis, U.K, 240pp. (John Hay, University of the South Pacific)   | Self-promotion.  |
| 380 | 57575 | 10 | 19        | 7         | 19      | 7       | .. Implications for tourists, tourist operators and destinations, ... (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)  | Tourists already mentioned in previous sentence.   |
| 381 | 68243 | 10 | 19        | 15        | 19      | 15      | "while leisure is done at home" - this definition of leisure is not the standard one. In addition, I do not think it is from Smith (1990), as he refers to the "leisure industry" - covering tourism and recreation. From Boniface and Cooper (2005): "Leisure: the time available to an individual when work, sleep and other basic needs have been met". Recreation and tourism are leisure activities. My recommendation is to drop the sentence "while leisure is done at home". BONiface and Cooper (2005) "Worldwide destinations: the geography of travel and tourism". Elsevier. (Jacqueline M. Hamilton, Hamburg University) | clause dropped   |

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| 382 | 73122 | 10 | 19        | 17        | 19      | 18      | Couldn't recreationists also adapt by moving to a different location that has more of their desired recreation activities? Even if there is no literature on this, it could be acknowledged as a possibility that hasn't been studied to date. (UNITED STATES OF AMERICA)   | Replaced "location" with "region"   |
| 383 | 69095 | 10 | 19        | 18        | 19      | 18      | (Smith, 1990) is an old reference. In 20 years, a lot could have changed. No new references that can be used to underpin the statement? Think of Becken and Hay (2007) (is also already in the reference list) (NETHERLANDS)  | Reference replaced.   |
| 384 | 73123 | 10 | 19        | 21        | 22      | 44      | The tourism section gives the impression that climate impacts on ski resorts are one of the more important consequences of climate change. The section should be drastically reduced. In particular, the long paragraphs of very place specific findings are hard to parse. These are prime candidates for including in a table, similar to what is used in the energy supply section. The text can then focus on broader take-aways across the range of studies. Sometimes this is done well but other times it is hard to know what to make of all this detail. (UNITED STATES OF AMERICA)                                | Paragraph shortened.  |
| 385 | 82428 | 10 | 19        | 25        | 19      | 25      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)   | Rephrased to avoid reserved word.   |
| 386 | 73124 | 10 | 19        | 26        | 19      | 27      | These conclusions are superficial and very location specific. Qualify the wording. (UNITED STATES OF AMERICA)   | Sentence starts with "for instance"   |
| 387 | 73125 | 10 | 19        | 29        | 19      | 47      | Many of the studies reviewed here do not seem to match the definition of recreation (vs. tourism) provided at the beginning of the section. E.g., do most visitors to national parks live nearby, not requiring an overnight stay? Is the Newfoundland study specific to recreational salmon fishing? Are the ski studies specific to local skiers? (UNITED STATES OF AMERICA)  | Agreed. Changed the text to reflect that these papers are indicative of the impact of climate change on recreation, rather than on recreation per se. |
| 388 | 73126 | 10 | 19        | 40        | 19      | 41      | Why would trips be more enjoyable? (UNITED STATES OF AMERICA)   | Sentence culled as older study  |
| 389 | 71345 | 10 | 19        | 42        | 19      | 42      | The text indicates that (Kulshethra, 2011) "sees positive impacts on Canadian recreation in general." However, the referred article does not state this. This article specifically addresses the Canadian Prairies. Suggest revising. (CANADA)  | Revised   |
| 390 | 68244 | 10 | 19        | 43        | 19      | 43      | "find that people recreate indoors" - this conflicts with the authors' definition of leisure and recreation stated in line 15. (Jacqueline M. Hamilton, Hamburg University)   | Definition of leisure removed   |
| 391 | 57576 | 10 | 19        | 52        | 20      | 32      | Reüates many things knwon from AR4 - to be summarized and empasized on newer studies (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)   | Culled older references were possible   |
| 392 | 73127 | 10 | 20        | 1         | 20      | 33      | Add more about the impacts of extreme weather on tourism? For example, there already is a literature on the impact of hurricanes on tourism in island countries. What can we learn from these studies, knowing that the frequency and magnitude of such storms is expected to increase? This section seems too focused on the effects of temperature to the exclusion of other climate induced changes, such as extreme weather events. (UNITED STATES OF AMERICA)  | Literature on extreme weather and tourism is referred to. There is no literature on the impact of changes in extreme weather on tourism               |
| 393 | 73128 | 10 | 20        | 6         | 0       | 0       | Unclear if this is referring to the UK or elsewhere. Also distinguish between effects on recreation and tourism in cool climate zones vs. hot climate zones. (UNITED STATES OF AMERICA)   | First comment: rephrased; Second comment: No literature   |
| 394 | 73129 | 10 | 20        | 7         | 0       | 0       | Tourism in the Arctic is a very small part of total tourism and has a limited, specialized clientele. (UNITED STATES OF AMERICA)  | Rephrased to combine the three examples.  |
| 395 | 73130 | 10 | 20        | 10        | 20      | 15      | It may make sense to make the point here that developed countries may benefit while developing countries would be harmed. Also, developing countries are often more dependent on tourism as a source of income. They are often less diversified. (UNITED STATES OF AMERICA)   | The assertion in the comment is not supported by the studies listed; discussed below.   |
| 396 | 73131 | 10 | 20        | 11        | 20      | 12      | Sentence is unclear. The authors should clarify the text accordingly. Is the word "many" missing here after the semicolon? (UNITED STATES OF AMERICA)   | "many" added  |
| 397 | 77177 | 10 | 20        | 18        | 20      | 19      | This comment on the econometric approach is too generic and not informative. If the authors intend to explore the differences between the climate change economics approach of Bigano, Hamilton, Tol etc, and the tourism geography one of Gossling and Hall, I suggest at least to compare the cited work of the latter scholars (Gossling et Hall, 2006) with the reply to their criticism in Bigano, A., Hamilton, J.M., Maddison, D.J., and Tol, R.S.J. (2006), "Predicting Tourism Flows under Climate Change", An Editorial Essay, Climatic Change, Vol. 79, N. 3-4. Otherwise I suggest to drop the comment. (ITALY) | rephrased: representation of climate, average tourist   |
| 398 | 68245 | 10 | 20        | 19        | 20      | 19      | "The impact of climate change on demand may be more complicated than suggested by the econometric analyses reviewed above...". The authors should make clear which of the studies are econometric ones - for many readers it will not be clear which studies are econometric ones. It would be helpful to include some of the points made by Gössling and Hall. (Jacqueline M. Hamilton, Hamburg University)  | rephrased: representation of climate, average tourist   |



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|-----|-------|----|-----------|-----------|---------|---------|--|---|
| 399 | 73132 | 10 | 20        | 29        | 20      | 30      | Either provide a reference or delete the assertion that tourists from NW Europe will be more likely to stay in their home countries - and that "NW Europe is the main origin worldwide of international travelers at present". There are a number of statements made in this paragraph that need citations or should be deleted. Also, since this is an assessment, any general statements should rely on multiple studies. If there is only 1 study supporting a statement put in appropriate context (using "may" for example). (UNITED STATES OF AMERICA)   | reorganized first half of the paragraph to clarify that the results in the second half are taken from these studies; word limit prevents repeating references |
| 400 | 73133 | 10 | 20        | 32        | 20      | 32      | Is this true for low lying island countries too (e.g., Maldives)? Are they not represented in this study? (UNITED STATES OF AMERICA)   | Sea level rise is omitted; clarified  |
| 401 | 68246 | 10 | 20        | 35        | 0       | 0       | "Section 10.6.2 Recreation and Tourism Supply." This section includes information on the supply side of tourism in the narrow sense (firms, organisations and facilities serving tourists) as well as in a greater sense to include all aspects of the tourism product such as climate, landscape, coastline, water quality and so on. It would be helpful to make it clear what studies are looking at the impacts on the tourism industry and on the impacts to the environmental services provided by destinations (at particular times). It seems that many studies look at the change in environmental services relevant to tourism and some studies then speculate on or estimate changes in demand. There do not seem to be as many studies examining the impact on the industry. My recommendation is to make these different supply side aspects clear in this section. This should make it easier for practitioners that are used to the supply side = tourism industry definition to follow. (Jacqueline M. Hamilton, Hamburg University) | Reworking would add undue complication and space is limited.  |
| 402 | 73136 | 10 | 20        | 35        | 0       | 0       | This whole section on recreation and tourism should have a caveat that the effects are speculative and the evidence base is weak. (UNITED STATES OF AMERICA)   | Literature is robust for this section   |
| 403 | 73134 | 10 | 20        | 35        | 20      | 35      | We suggest reconsidering the section title. Many of the studies discussed seem to be more about tourism demand than supply. (UNITED STATES OF AMERICA)   | Moved biometeorology to demand  |
| 404 | 59464 | 10 | 20        | 35        | 22      | 44      | The analysis for tourism is very good. Some more economic data would be very beneficial though regarding the winter and summer tourism shifting following climate change. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)  | No literature   |
| 405 | 73135 | 10 | 20        | 35        | 22      | 44      | This section contains many references. Putting this information in a table would increase readability. (UNITED STATES OF AMERICA)  | Reorganized following Australia's suggestion  |
| 406 | 57577 | 10 | 20        | 37        | 0       | 0       | biometeorological to be replaced, with "tourism-climatological" (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)   | commenter uses "biometeorological" in many of his publications  |
| 407 | 57578 | 10 | 20        | 37        | 22      | 44      | I recommend to separate in summer, winter and all year tourism concerning studies done (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)  | Adaptation includes switching season  |
| 408 | 80192 | 10 | 20        | 37        | 22      | 44      | Section 10.6.2 considers recreation and tourism supply. It does not discuss evidence about the impacts of adverse weather and climate change on the supply of labor, small enterprises, and employment (that is arguably part of supply). A forthcoming study did a survey of about 1100 small enterprises (tourism, agriculture) in Jamaica, Belize, Grenada, and St. Lucia and found that a primary concern of suppliers of tourism services was adverse weather: 42% of the sample had experienced some loss due to extreme weather since 2000, but also loss of occupation (the most prominent risk). Source: : Lashley, J., Warner, K. 2013. Evidence of implicit and explicit demand for weather-related microinsurance in the Caribbean. Climatic Change. Special Issue "Advancing Climate Adaptation and Risk Management. New Insights, Concepts and Approaches" (Birkmann, Mechler editors). (Koko Warner, United Nations University - Institute for Environment and Human Security)  | Paper not published in time   |
| 409 | 68093 | 10 | 20        | 44        | 20      | 44      | It is suggested to add POC after Taiwan. (CHINA)   | added   |
| 410 | 77178 | 10 | 20        | 45        | 20      | 47      | Please explain briefly the index mentioned in line 45 and its differences/similarities with the Tourist Comfort Index used for instance by Amelung and Moreno. In general this subsection would benefit from a paragraph or a short box explaining the biometeorological indexes approach as applied in the climate change and tourism literature. (ITALY)   | Space constraints limited additional detail   |
| 411 | 57579 | 10 | 21        | 2         | 0       | 0       | not weather index but climate index (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)   | text correctly states: weather index  |
| 412 | 68247 | 10 | 21        | 12        | 21      | 13      | "but in a different matter than typically assumed by biometeorologists". The authors should explain this. Do they mean "Way" instead of "matter"? What way do biometeorologists assume? And what are the findings of the four studies. (Jacqueline M. Hamilton, Hamburg University)  | typo corrected; rest ed: no space   |

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| 413 | 60003 | 10 | 21        | 15        | 21      | 52      | This section is far too long. Suggested rewording: Studies on the supply side often focus on ski tourism. Warming is expected to raise the altitude of resorts with reliable ski fields (Hendrikx et al, 2012; Steger et al 2012) and artificial snow-making is unlikely to be able to meet the deficit (Elsasser and Burki, 2002). This could result in economic loss with consumers indicating a preference for natural over artificial snow in many regions (Wolfsegger, et al 2008, Morrison and Pickering, 2012; Pickering et al 2010). Further, while artificial snowmaking might slow the decline of some ski resorts, water scarcity and the costs of snowmaking would make it increasingly difficult both physically and economically (Matzarakis et al 2012; Scott et al 2003; Scott et al, 2007; Hendrikx and Hreinsson, 2012; Steiger and Mayer, 2008; Pons-Pons et al, 2012) with some areas and resorts becoming economically unviable (Pickering and Buckley 2010; Moen and Fredman, 2007). As a result, tourism alternatives to skiing are going to be the most likely adaptation response (Serquet and Rebetex, 2011) or growth in other non-tourism alternatives as a source of economic development (Bourdeau 2009). (AUSTRALIA)   | Paragraph shortened and reorganized along the lines suggested.   |
| 414 | 73137 | 10 | 21        | 15        | 21      | 52      | Hendrikx et al. (2013) should perhaps also be included in this discussion. Hendrikx, J., C. Zammit, E. Hreinsson, S. Becken. 2013. A comparative assessment of the potential impact of climate change on the ski industry in New Zealand and Australia. Climatic Change. <a href="http://link.springer.com/article/10.1007/s10584-013-0741-4">http://link.springer.com/article/10.1007/s10584-013-0741-4</a> . (UNITED STATES OF AMERICA)   | Reference added  |
| 415 | 77179 | 10 | 21        | 16        | 21      | 16      | Warming of what? Perhaps mountain slopes? This sentence is missing a crucial detail, I guess. (ITALY)   | dropped "of"   |
| 416 | 57580 | 10 | 21        | 19        | 0       | 0       | Schmidt et al (20123) not in referenecs list (Andreas Matzarakis, Albert-Ludwigs-University Freiburg)   | added  |
| 417 | 82429 | 10 | 21        | 25        | 21      | 27      | The relevant time frame for this statement should be clarified. Is the author team indicating that the need for adaptation has already exceeded the ability to adapt, or that this outcome is expected over some future time frame? (Katharine Mach, IPCC WGII TSU)   | added: before 2025   |
| 418 | 77180 | 10 | 21        | 30        | 21      | 31      | Please rephrase the sentence starting with "They" and ending with "ones"; it doesn't sound like good English to me (e.g. move "low-lying ones" next to "resorts"). (ITALY)  | confirmed syntax   |
| 419 | 61962 | 10 | 22        | 21        | 0       | 0       | Therer are plenty more studies relating to fish size, diversity etc in the context of MPA development (see refs in various Roberts C. et al papers and others) that suggest many other impacts may come into play on tourism WTP. Secondary impacts of over-fishing may come into play as farmers and migrants across scales turn to the sea, for reasons that may not be related to climate impacts on the coast itself. (Matthew Bunce, Institute of Marine Engineering, Science and Technology)  | covered elsewhere in report.   |
| 420 | 60004 | 10 | 22        | 21        | 22      | 21      | Suggest removing sentence starting with (Uyarra et al 2005) and replace with: Studies of tourism destinations based around access to coral reefs such as Australia's Great Barrier Reef and around the Caribbean island of Bonaire indicate tourist decline following bleaching events and degradation of diving sites (Uyarra, et al. 2005; Hoegh-Guldberg, O and H Hoegh-Guldberg, 2008, The impact of climate change and ocean acidification on Great Barrier Reef and its tourist industry, Garnaut Climate Change Review, <a href="http://www.garnautreview.org.au/ca25734e0016a131/WebObj/01-IGreatBarrierReef/\$File/01-1%20Great%20Barrier%20Reef.pdf">http://www.garnautreview.org.au/ca25734e0016a131/WebObj/01-IGreatBarrierReef/\$File/01-1%20Great%20Barrier%20Reef.pdf</a> ; Oxford Economics, 2009, Valuing the effects of Great Barrier Reef bleaching, Great Barrier Reef Foundation, Brisbane, Queensland, <a href="http://www.barrierreef.org/Portals/0/Oxford_report/GBRF_OxfordReport_Final_WEB.pdf">http://www.barrierreef.org/Portals/0/Oxford_report/GBRF_OxfordReport_Final_WEB.pdf</a> ; Miles, RL, S Kinnear, C Marshal, G O'Dea and L Greer, 2009, Assessing the socio-economic implications of climate change (coral bleaching) in the Great Barrier Reef Catchment, Synthesis Report, Central Queensland University, Rockhampton, Queensland, <a href="http://www.rrrc.org.au/publications/downloads/25i4-CQU-Miles-R-et-al-2009-January-Milestone-and-Synthesis-Report.pdf">http://www.rrrc.org.au/publications/downloads/25i4-CQU-Miles-R-et-al-2009-January-Milestone-and-Synthesis-Report.pdf</a> (AUSTRALIA) | the proposed sentence does not reflect Uyarra's conclusion; other suggested papers are gray literature |
| 421 | 73138 | 10 | 22        | 37        | 22      | 38      | Is this a finding from Ceron and Dubois (2005)? If so, it would be helpful to indicate it in the sentence that you are still talking about this study. (UNITED STATES OF AMERICA)   | No space for repeat reference; replaced full stops with semicolons.                                    |
| 422 | 73139 | 10 | 22        | 39        | 22      | 41      | The Jones et al. (2006) study doesn't really seem to fit in this paragraph given the rest of the studies seem to be ones that try to consider all tourism impacts for a particular country or region. Perhaps this can be moved up to a previous paragraph or deleted? (UNITED STATES OF AMERICA)   | Moved to recreation  |
| 423 | 68248 | 10 | 22        | 40        | 21      | 40      | "fret that the dates of...". It would be better to replace "fret" with a neutral word. (Jacqueline M. Hamilton, Hamburg University)   | dropped "fret"   |
| 424 | 84618 | 10 | 22        | 47        | 0       | 0       | Section 10.6.3: Are numerical results available to support the statement in the ES that economic impacts may be "substantial"? Currently it is not clear what magnitude the available evidence suggests. (Michael Mastrandrea, IPCC WGII TSU)   | Removed substantial from ES  |

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| 425 | 60005 | 10 | 22        | 49        | 22      | 50      | It is hard to comprehend that there are only two papers internationally that consider the economic impacts of climate change induced changes in tourism supply and demand. Suggest that this sentence be reworded to: There are limited studies considering the economic impacts of..." (AUSTRALIA)   | There are two studies only that we know of. Australia does not provide references. |
| 426 | 73140 | 10 | 22        | 53        | 0       | 0       | This statement is over-simplified and does not reflect the earlier discussion about decreases in the ski tourism industry in cold countries. (UNITED STATES OF AMERICA)   | text reports accurately the literature findings                                    |
| 427 | 73141 | 10 | 23        | 1         | 23      | 1       | Please note the geographic region under study in Bigano et al. (2008a). (UNITED STATES OF AMERICA)  | Clarified: Global  |
| 428 | 73142 | 10 | 23        | 1         | 23      | 5       | Do you have a citation for this observation? Is this result mainly applicable in a developed country context? (UNITED STATES OF AMERICA)  | Citation at the start; clarified that the scope is global.                         |
| 429 | 71483 | 10 | 23        | 8         | 28      | 0       | Section 10.7.: The authors could consider organizing the sub-section along the lines of four potential roles of insurance in the context of risk management and adaptation: a) Insurance as a decision making support tool: Identifying and pricing risks, regardless of whether insurance is part of the mix of tools chosen to actually address the risks identified). The compilation and availability of good historical and current data needed to underpin insurance products can generate a public good which decision-makers can possibly access to develop plans to strengthen the resilience of their countries and communities. b) Incentivizing loss reduction & resilience building activities through insurance: Increase risk reduction awareness which has the potential to be translated into increased risk reduction activities by individuals. c) Reducing financial repercussions of volatility and create more certainty in decision-making: Free up governments to spend money on other investments and provide additional policy space to introduce other services (e.g. use of credit in agriculture). d) Insurance can provide timely finance to address damage when events such as floods, cyclones, droughts, or other weather stresses occur. Insurance payments can provide immediate post-disaster liquidity to governments and individuals. Additional references and sources for these issues are explored in Warner et al (2012): Insurance solutions in the context of climate change-related loss and damage: Needs, gaps, and roles of the Convention in addressing loss and damage. Munich Climate Insurance Initiative (MCII) submission to the SBI Work Programme on Loss and Damage, October 2012. Policy Brief No. 6. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS). Alternative reference: Warner, K., Kreft, S., Zissener, M., Höpfe, P., Bals, C., Loster, T., Linnerooth-Bayer, J., Tschudi, S., Gurenko, E., Haas, A., Young, S., Kovacs, P., Dlugolecki, A., and A. Oxley (2013): Insurance Solutions in the Context of Climate-Change-Related Loss and Damage: Needs, Gaps and Roles of the UNFCCC in Addressing Loss and Damage. In: Ruppel, O. C., C. Roschmann and K. Ruppel-Schlichting (Eds): Climate Change Policy, International Diplomacy and Global Governance, Baden-Baden, Nomos. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS)) | Thank you for the suggestion. Space constraints limit options for restructuring.   |
| 430 | 71484 | 10 | 23        | 8         | 28      | 0       | Section 10.7.: Sub-chapter on insurance seems to focus primarily on private-sector insurance, which is misleading since the public sector is also active in this space and some of the early innovative efforts around climatic risks and risk transfer are coming out of the public sector. It is acknowledged that the provision of insurance is difficult under climate change because of increasing struggle of primary insurers. The sub-section on insurance requires much more evidence and citations of literature about wider provision of risk transfer that includes public sector - these could include e.g. Mexico's FONDEN (Hofliger, R., Mahul, O., Ghesquiere, F., and S. Perez (2012): FONDEN - Mexico's Natural Disaster Fund - A Review. Global Facility for Disaster Reduction and Recovery. Washington DC) and other examples from the "compendium of disaster risk transfer initiatives in the developing world" collected by ClimateWise: <a href="http://www.climatewise.org.uk/climatewise-compendium/">http://www.climatewise.org.uk/climatewise-compendium/</a> (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))   | Referred to Chpt 17  |

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| 431 | 71485 | 10 | 23        | 8         | 28      | 0       | Section 10.7.: Chapter sub-section on insurance currently lacks a clear organization around the types of insurance tools, advantages or disadvantages of parametric vs indemnity approaches for adaptation. It might be more helpful to the audience if there was further elaboration on the types of insurance approaches and how they can help build (financial) resilience in the face of weather extremes today. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))  | Other than traditional indemnity-based insurance (i.e. damages and losses are assessed by loss adjusters as a basis for payout), index-based parametric insurance is a still small but emerging segment that within agricultural (and livestock) business is of particular interest in middle- and low-income countries, where the saving of loss adjustment costs might contribute to desirable low-cost schemes. As a consequence, the focal point for the discussion of parametric insurance should be placed where adaptive responses in middle- and low-income countries are dealt with. This is exactly what we are doing in 10.7.5.2 and table 10-7, where the particular features of such schemes that constitute difference from traditional indemnity-based schemes are prominently discussed in terms of pros and cons (skipping of adjustment costs, reduction moral hazard and adverse selection, problems of basis risk and misunderstanding, possible improvements of basis risk, etc.). Other types of parametric triggers are adopted with insurance-linked securities that transfer risk to the capital market and with sovereign insurance concepts. Again, these features are discussed in their relevant contexts 10.7.5.1., 10.7.5.2 and table 10-7. |
| 432 | 71486 | 10 | 23        | 8         | 28      | 0       | To support the conclusions / recommendations from SREX, the sub-chapter on insurance (10.7) could feature promising case studies such as (among others) HARITA / R4 ( <a href="http://home.wfp.org/stellent/groups/public/documents/communications/wfp240451.pdf">http://home.wfp.org/stellent/groups/public/documents/communications/wfp240451.pdf</a> ), Index-based livestock insurance in Mongolia (Mahul, O., Belete, N., A. Goodland (2009): Index-based livestock insurance in Mongolia. International Food Policy Research Institute (IFPRI)) at the local level; or Caribbean Catastrophe Risk Insurance Facility (CCRIF, <a href="http://www.gfdr.org/sites/gfdr.org/files/documents/DRFI_CCRIF_Jan11.pdf">http://www.gfdr.org/sites/gfdr.org/files/documents/DRFI_CCRIF_Jan11.pdf</a> ) at the more national/regional level. A more comprehensive collection of case studies can be found in a literature review submitted to the UNFCCC in 2012. Reference: UNFCCC (2012) A literature review on the topics in the context of thematic area 2 of the work programme on loss and damage: a range of approaches to address loss and damage associated with the adverse effects of climate change. FCCC/SBI/2012/INF.14. Available from: <a href="http://unfccc.int/documentation/documents/advanced_search/items/6911.php?preref=600007098#beg">http://unfccc.int/documentation/documents/advanced_search/items/6911.php?preref=600007098#beg</a> (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS)) | Due to space constraints it is not possible to include a bunch of case studies beyond the discussion of the essentials. CCRIF is touched in 10.7.5.2. and the literature cited in 10.7.5.2. and table 10-7 (including SREX) is covering most of the individual schemes and projects.   |
| 433 | 73143 | 10 | 23        | 8         | 28      | 33      | The section on insurance is well written and nuanced. It is much better written than the insurance discussion in the economics of adaptation chapter (ch. 17). That said, some of it may be better suited for inclusion in Chapter 17 on adaptation. It is recommended that the authors of the 2 chapters coordinate to ensure that the discussion in the two chapters is complementary. (UNITED STATES OF AMERICA)  | Coordination between all sectoral chapters dealing with insurance topics is in effect, also including coordination between chapters 10 (10.7) and 17 (17.5.1). We have arranged that chapter 17's discussion of insurance should have a focal point at the demand side, whereas in 10.7 a complementary focus on the supply side is intended. Accordingly, when discussing the deficits of insurance to incentivize vulnerability reduction, 17.5.1 argues against the background of demand and behaviour (social norms, mortgage requirements, moral hazard, etc.), while 10.7.5.1 hints at supply side features that hinder risk-based premiums as an incentive for risk reducing response (price regulation, competitive pressures, etc.). Notwithstanding, some overlap seems unavoidable, given insurance is a basis concept also for the adaptation chapters.  |

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| 434 | 73144 | 10 | 23        | 10        | 23      | 17      | It seems important to point out right away that insurance markets are relatively well developed in high income countries, and relatively non-existent in low-income countries. And that for low-income countries hard hit by natural disasters, insured losses are a poor proxy for the damages that have been incurred. (UNITED STATES OF AMERICA)  | The fact raised by the comment is expanded in 10.7.4.2, where it is stated that in high-income countries some 35% of direct natural disaster losses are covered by insurance, whereas only 5% (1% in middle-income (low-income) countries. As a consequence of such an uneven distribution, the discussion is strictly split between high-income versus middle- and low-income countries (10.7.4 - 10.7.6).   |
| 435 | 73145 | 10 | 23        | 12        | 23      | 13      | What is meant by "growing with the economy everywhere?" - as incomes grow more losses are insured? Please consider revising with more specific language. (UNITED STATES OF AMERICA)  | Wording has been changed ("[...] which is expanding coverage with economic growth.>").  |
| 436 | 73146 | 10 | 23        | 15        | 23      | 37      | This section would benefit from an expanded and more climate centric discussion of the role of insurance: Insurance does not reduce risk, it spreads and redistributes risk. Thus, insurance does not reduce risk to society as a whole. Risk or a change in risk, defined as the probability of an adverse event, is, in principle insurable. Uncertainty, defined as an unquantifiable potential for an adverse event, is not insurable. Private firms generally offer insurance only a few years into the future at most. Long-term future risks are generally not insurable, in part because they are uncertain. Thus, climate-related risks will affect insurance markets incrementally over time. Higher premia may be a useful market signal to induce adaptation action. Climate-related uncertainty may inhibit or raise the cost of the provision of weather or catastrophe insurance generally. Insurance can protect against public or private financial costs of repairing or replacing damaged infrastructure, but generally does not protect against the public against operational or social losses, partly in the form of lost consumer surplus, from infrastructure failures. So, if an insured bridge is washed out, the owner can replace the bridge, but the users of the bridge will suffer an uncompensated loss from their inability to use the bridge. Climate adaptation strategies can be viewed as a mechanism to reduce the risk of long-term future financial and operational losses for which financial insurance is not generally available (UNITED STATES OF AMERICA) | The intention of this opening section is just to introduce FUNDAMENTALS / BASIC PRINCIPLES of insurance regarding weather hazards, it is not the place for an in-depth discussion of all climate-related aspects. As the caption "Societal Role..." might not sufficiently transport this intention, it was replaced by "Fundamentals of Insurance...". More detailed discussions that touch on several elements raised by the comment follow throughout section 10.7. -- The comment states "...insurance does not reduce risk to society as a whole" - Not correct. Comparing countries with high insurance penetration to those with low insurance penetration in the aftermath of weather-related disasters shows that the former group experiences almost no impact on sovereign deficit but an increase in output (GDP) in the years following the disaster. Opposite to this, the latter group experiences clearly rising government deficit and no positive change in output (Melecky and Raddatz, 2011; similar results found by von Peter, von Dahlen, and Saxena, 2012). Hence, economic vulnerability is reduced for the society. The relevant literature is now included at this spot. But also from an individual perspective, one can state that insurance effectively reduces the risk of individual ruin which is one of the most prominent achievements and the ultimate cause for insurance systems to evolve. |

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| 437 | 80193 | 10 | 23        | 20        | 39      | 0       | Section 10.7.2 discusses the societal role of insurance covering weather hazards. However, it is skewed primarily to private sector experience even though the section title suggests "societal role" -- one would expect some reflection on public sector experience, as well as some comments on insurance as a concept of "assurance". A recent policy brief by MCI provides several sources of evidence that this section may want to reference (look at the reference section of the policy brief: (Koko Warner; Sönke Kreft; Michael Zissener; Peter Höppe; Christoph Bals; Thomas Loster; Joanne Linnerooth-Bayer; Silvio Tschudi; Eugene Gurenko; Armin Haas; Simon Young; Paul Kovacs; Andrew Dlugolecki; Aaron Oxley (2012). Insurance solutions in the context of climate change-related loss and damage. Policy Brief No. 6. UNU-EHS, Bonn. November 2012. <a href="http://www.ehs.unu.edu/article/read/policy-brief">http://www.ehs.unu.edu/article/read/policy-brief</a> ). (Koko Warner, United Nations University - Institute for Environment and Human Security)  | As the intention of this opening section is just to introduce FUNDAMENTALS / BASIC PRINCIPLES of insurance regarding weather hazards irrespective of the institutional frame, particular weight is shifted neither to private sector arrangements nor to the public sector. Accordingly, most of the fundamentals listed apply to both private and public types of insurance, namely spreading risk over a pool of insureds and over time, the law of large numbers as a principle, the problems encountered by correlated risk which raises levels of risk-based capital. Not only private insurers but also public schemes such as FONDEN or CCRIF have to approach reinsurance and capital markets in order to make their systems work, given correlated risk and the associated need for high levels of risk-based capital. Although governments might have better conditions to raise capital to cover the costs in exceptional situations (depending on the financial state of the particular country), there might be budgetary competition that motivates to also reinsure peak risk. As the caption "Societal Role..." might not sufficiently transport the intention of the authors to just introduce the very fundamentals of the way insurance against weather-related risks works within societies , it was replaced by the wording "Fundamentals of Insurance....". See also above at comment no. 430. |
| 438 | 80194 | 10 | 23        | 20        | 39      | 0       | The section 10.7.2 could comment on the following roles that insurance could play in a wider, not-necessarily-commercial role to manage weather hazards: assessing loss and damage potential, incentivizing loss reduction and resilience building activities (you could look at evidence cited in the 1st and 2nd volumes of the Microinsurance Compendium by ILO, the 2009 book on climate change and insurance by the Geneva Association, Hellmuth et al. 2010 on microinsurance and weather-based indices in poor countries; reducing the financial repercussions of volatility and creating more certainty in decision making (tools like the Caribbean Catastrophe Risk Insurance Facility have been created for this purpose, and analysed in the literature recently by Mechler and Dlugolecki, Simon Young, and others); and providing timely finance to cover loss and damage (look at articles by Hazel, Kunreuther and Kerjan, Linnerooth-Bayer and Mechler). You can also find these points and further references on evidence in the publication: Koko Warner; Sönke Kreft; Michael Zissener; Peter Höppe; Christoph Bals; Thomas Loster; Joanne Linnerooth-Bayer; Silvio Tschudi; Eugene Gurenko; Armin Haas; Simon Young; Paul Kovacs; Andrew Dlugolecki; Aaron Oxley (2012). Insurance solutions in the context of climate change-related loss and damage. Policy Brief No. 6. UNU-EHS, Bonn. November 2012. <a href="http://www.ehs.unu.edu/article/read/policy-brief">http://www.ehs.unu.edu/article/read/policy-brief</a> ). (Koko Warner, United Nations University - Institute for Environment and Human Security) | Section 10.7.2 is just meant to introduce FUNDAMENTALS / BASIC PRINCIPLES of insurance regarding weather hazards as a starting point for other more detailed discussions in the following sections. In these sections other aspects such as loss assessment, the potential to incentivize loss / vulnerability reduction, to reduce repercussions of sovereign fiscal volatility following major catastrophes ("financial gap" problem), etc. are dealt with. As the caption "Societal Role..." of section 10.7.2 might not sufficiently transport the intention of the authors to just introduce the very fundamentals of the way insurance against weather-related risks works within societies , it was substituted by the wording "Fundamentals of Insurance....". See also at comment no.437.   |

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| 439 | 68094 | 10 | 23        | 22        | 23      | 23      | This paragraph fails to adequately reflect the limitations of insurance in climate change adaptation. For example, insurance cannot address the losses caused by a gradient/slow onset event, nor can it transfer the risk of loss of life. It is suggested to add in Line33 that "It must be noted that insurance may not be the right mechanism for slow onset events. And the risk of the loss of human life be transferred, which calls for other type of innovative solutions, including rehabilitation and compensation" (FCCC/SBI/2012/29,2012) (CHINA) | The comment states that the risk materializing in loss of life cannot be transferred. This is correct from a passionate humanitarian perspective, but not in terms of life insurance products where payouts are triggered by the unfortunate loss of a family's bread-earner, e.g. a fisherman who lost his life by the force of a tropical cyclone. Such covers (also required in microinsurance markets) can help the family to re-start economically and avoid getting trapped in poverty. The comment also states that low onset events are not covered by insurance. This depends on the time scale implied by the phrase "slow onset". For instance, drought -- reducing crop yields and livestock -- is covered by agricultural/livestock insurances, and compared to floods or wind storms, drought often has slow onset characteristics. Admittedly, slow-onset events at time scales of years are at some stage foreseeable and thus are in conflict with the idea of stochastic and unforeseeable events that define insurance applicability. Also the loss of some non-monetarized values that might change slowly and have some connectivity to climate change cannot be insured, e.g. loss of cultural heritage (e.g. indigeneous people), loss of social comfort, etc. Instead of listing limitations, it seems to be more straightforward to positively state what insurance is about. Crucially, this section just introduces the very fundamentals / basic principles of insurance - nothing more. As the caption "Societal Role..." might not sufficiently transport this intention of the authors, it was replaced by the wording "Fundamentals of Insurance....". |
| 440 | 73147 | 10 | 23        | 22        | 23      | 24      | This is a form of adaptation (reference chapter 17). (UNITED STATES OF AMERICA)  | Correct. Adaptation to weather-related risk, and also to changes in weather-related risks is the very essence of insurance. Hence, it has to be explained here -- at the very spot, where the essentials of insurance are outlined. A cross reference to chapter 17 has been added.  |
| 441 | 73148 | 10 | 23        | 27        | 23      | 28      | Does this description include droughts? (UNITED STATES OF AMERICA)   | Correct. Droughts are another example of correlated risks, where many (e.g. farmers) are affected by one and the same event. Flood was used just as an example.  |
| 442 | 82430 | 10 | 23        | 28        | 23      | 28      | The author team should ensure there is a probabilistic basis for this likelihood assignment. If not, assigning a level of confidence or summary terms for evidence or agreement may be appropriate. (Katharine Mach, IPCC WGII TSU)  | This is not a likelihood assignment. To clarify this, wording has been changed.  |
| 443 | 73149 | 10 | 23        | 35        | 23      | 35      | Explain how insurers will need to change their business model in response to climate change. One possibility is that they will refuse to offer policies in highly vulnerable areas as risks increase. (UNITED STATES OF AMERICA)   | Correct, refraining from offering coverage in high-risk areas will be one of the options. This option is stated in Table 10-7 (p.70): "exclusion of systematically affected property." Much more options are discussed in 10.7.5 and Table 10-7, where "Products and Systems Responding to Changes in Weather Risks" come into focus.  |

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| 444 | 73150 | 10 | 23        | 54        | 24      | 46      | It might make sense to start the insurance section with information on loss trends and how much is or is not attributable to climate change. Not all of the losses reported are climate change induced. Please clarify what is being reported here. For example, is Barthel and Neumayer limited to climate change attributable losses? If not, it is not appropriate to cite here. (UNITED STATES OF AMERICA) | Reported are results from the literature on loss trends and climate change. First step is always detection of trend, second step comprises efforts to attribute the detected trend to one or several drivers. Besides prevalent socio-economic drivers of change, also climatic changes have a role in some cases. The findings do not allow to single out loss time series that are exclusively driven by changes in frequency or intensity of weather-related events, but regularly a bundle of drivers is involved, calling for differential analyses. The status of research findings with respect to the cofounders has to be presented. |
| 445 | 73151 | 10 | 24        | 45        | 24      | 52      | Nordhaus (2010) may also be worth citing here. Nordhaus, W. The economics of hurricanes and implications of global warming. Clim. Change Econ. 1, 24 (2010). (2010). (UNITED STATES OF AMERICA)  | Correct. Nordhaus, 2010 has been included; additionally also the recent studies on emergence timescales for detection of anthropogenic climate change in hurricane losses, and this approaches explicated (Crompton et al., 2011; Emanuel, 2011) -- in particular as one of these studies refers to insured hurricane losses (Emanuel 2011).  |
| 446 | 73152 | 10 | 24        | 47        | 0       | 0       | North Atlantic of the US, Canada or Europe? (UNITED STATES OF AMERICA)   | Wording has been changed, whole paragraph has been better structurized and clarified (see also at comment no.445).  |
| 447 | 59465 | 10 | 25        | 0         | 25      | 0       | Health is very critical aspect of human life and it is not analysed using a specific chapter as energy, water and transport. I wonder why. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)   | See Chapter 11 of this assessment   |
| 448 | 79535 | 10 | 25        | 2         | 25      | 2       | Previous references have listed the location to which the change in insured loss applies. Can the location reference (Japan?) be given in the text for the paddy rice quote? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | Correct: Location (Japan) has been added.   |
| 449 | 73153 | 10 | 25        | 8         | 25      | 8       | This sentence is unclear. Please reword to make the connection to the rest of the paragraph more apparent. (UNITED STATES OF AMERICA)  | Sentence has been rephrased.  |



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| 450 | 80195 | 10 | 25        | 13        | 40      | 0       | Section 10.7.4.1 talks about supply side challenges and sensitivities for insurance. Here again, the chapter section is biased towards private sector. This misses a lot of valuable experience in the public sector, and also the interaction between the private and public sector (as the case of heavily publically-supported agricultural insurance schemes in many industrialized countries). This sub-section mentions just one public program (NFIP), but could additionally reference the British approach to bundling multiple perils (flood, fire--look at literature by Dlugolecki for example, and ABI), the French public insurance system, the Japanese system, etc. Joanne Linnerooth-Bayer, Paul Kovac are two authors that have analysed these public insurance systems. Really more analysis and mention is needed, since the public sector plays a key role in the provision of insurance in key sectors (particularly agriculture, covering public infrastructure). Similarly, this section also needs to mention concepts of "self-insurance" and what the costs are of that (trade-off between self-insuring, and having resources to invest in other things--that is particularly a challenge for the public sector). (Koko Warner, United Nations University - Institute for Environment and Human Security) | The subsection on supply-side challenges and sensitivities is again split into high-income countries 10.7.4.1 (which the comment is referring to) and middle- / low-income countries (10.7.4.2) which the comment is not touching. Given very limited space, we have not had a specific focus on private insurance arrangements, but rather on fundamental challenges and sensitivities in high-income contexts. As the comment mentioned, 10.7.4.1. and Table 10-6 are stepping into a detailed discussion of the public flood insurance system NFIP in the US. -- First paragraph - Apart from the service to shareholders' equity, the fundamental need for balancing between costs and affordability outlined here applies equally to public insurance arrangements. -- Second paragraph - The need to reflect changes in weather-related losses in an insurer's risk management is essential for both private and public schemes, and NFIP is discussed as a public example for incentive problems. -- Third paragraph - The additional uncertainty from climate change will affect all types of insurance, and the lines of business potentially affected by climate change also include products from public arrangements. Also in 10.7.4.2 (middle-/low-income countries), all paragraphs pertain to both public and private insurance arrangements, including agricultural insurances. As always, there are more challenges and sensitivities that could be dealt with besides those fundamental ones, given extended space. PPP arrangements in the context of agricultural insurance schemes in developing countries are dealt with in 10.7.6.2. See also above at comments 430 and 437. |
| 451 | 73154 | 10 | 25        | 19        | 0       | 0       | Also, it depends on the price and availability of re-insurance. (UNITED STATES OF AMERICA)  | Correct. Here the intention was to outline the fundamental challenge of balancing affordability of premiums and costs as a precondition of the provision of weather hazard insurance. In more detail, the role of reinsurance is touched in 10.7.5.1 and 10.7.6.2.  |
| 452 | 79536 | 10 | 25        | 24        | 25      | 26      | AR5 chapter 10 page 15 lines 13-15 indicate via a more recent reference that the 'misguided incentives' in the US National Flood Insurance Programme have been at least partly addressed by requiring communities to reduce risks before homeowners can access insurance. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)  | Reference to chapter 10 p.15 lines 13-15 is erroneously made. It is 17.5.1 (SOD page 15, lines 12 - 15) which the comment refers to. Here it is not stated that NFIP already has addressed the "misguided incentives", but rather that NFIP "requires communities to reduce risks before homeowners can access insurance for their homes" (ibid.). This is not in conflict with our statement on NFIP's misguided incentives to increase development in high-risk areas, as we explained in some detail in Table 10-6: the community rating with respect to NFIP (premiums) depends on preventive measures taken by the community, and premium discounts following some community measures have contributed to spur development in some places. As a consequence, exposure, vulnerability and consequentially risk have been increasing even more, in particular as substantial events have overtopped levees and inundated the developed flood plains. These linkages have been analysed in the literature.  |

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| 453 | 69096 | 10 | 25        | 36        | 25      | 38      | The example included needs more detail in order to be relevant and clear. For example, there needs to be information included on what the 'decision made' is about. As it stands this example could refer to any decision. (NETHERLANDS)   | Wording has been changed. Equally important is the reference to Table 10-6 given at the end of the paragraph, where the decision of the Supreme Court of Virginia: Steadfast vs. AES, 2012 is discussed.  |
| 454 | 80196 | 10 | 25        | 41        | 26      | 21      | Section 10.7.2.3 similarly has an unbalanced focus centering around private sector insurance. Yet some of the particularly innovative weather risk insurance solutions in middle and low income countries are being undertaken in public / or public-private partnership (lines 43 - 47 could mention some of these examples--FONDEN in Mexico, micro-level examples of which dozens are available--see the 2 volumes of the Microinsurance compendium by ILO, Hellmuth et al. 2009, MCII policy briefs 2010 and 2012 for many examples to reference (see reference sections of Warner, K., Loster, T., Zissener, M., Kreft, S., Linnerooth-Bayer, J., Bals, C., Hoeppe, P., Gurenko, E., Burton, I., Haas, A. (2009) Vulnerable Countries and People: How Disaster Risk Reduction & Insurance Can Help Manage the Risks of Climate Change. UNU-EHS Policy Brief. United Nations University. October 2009; and Koko Warner; Sönke Kreft; Michael Zissener; Peter Höppe; Christoph Bals; Thomas Loster; Joanne Linnerooth-Bayer; Silvio Tschudi; Eugene Gurenko; Armin Haas; Simon Young; Paul Kovacs; Andrew Dlugolecki; Aaron Oxley (2012). Insurance solutions in the context of climate change-related loss and damage. Policy Brief No. 6. UNU-EHS, Bonn. November 2012. <a href="http://www.ehs.unu.edu/article/read/policy-brief">http://www.ehs.unu.edu/article/read/policy-brief</a> ); The mentions of weather insurance for low-income people on page 26 (lines 9-14) focuses on subsidies but this seems like a really limited telling of the full story: what might be more interesting to talk about would be the growing experience linking provision of credit and insurance in many microinsurance approaches, mention of parametric approaches that avoid some of the costs of indemnity / loss adjustment and newer programs that attempt to incentivize risk reduction as a condition for or benefit of participation (like linking early warning systems via cell phone technology). This approach is being tested in the Caribbean (see Lashley and Warner ), in Kenya (MPesa, discussed in ILO Microinsurance compendium), in Ethiopia (community-based disaster risk management embedded in the R4 /HARITA approach), in Mongolia (discussed by Jerry Skees). etc. This section just misses some of the more interesting, public and private sector emerging experience in providing insurance in low income country contexts. And those experiences will be important to understand in the context of attempts to adapt to climate change. Please do a deeper dive into those literatures. The section needs to mention some of the challenges that may not be obvious, like the financial regulations (especially for low-income portions of the market, regulation of parametric products), financial risk management capacity, financial back-up at higher levels like government backing, reinsurance, etc.). These issues are discussed in chapters of the ILO Microinsurance Compendium. (Koko Warner, United Nations University - Institute for Environment and Human Security) | The comment might have overlooked the overall arrangement of the section on insurance in 10.7. Most elements of the in-depth discussion on weather-risk insurance in developing countries required by the comment are presented in the next subsections, i.e. in 10.7.5.2 with Table 10-7, and in 10.7.6.2 with Table 10-8. According to the overall arrangement, in 10.7.2 the fundamental supply-side challenges and sensitivities associated with currently existing insurance systems are outlined (which might pose starting points for problems exacerbated with climate change), but not an exhaustive discussion on details intended. In regard to adapting insurance systems to climate change, subsections 10.7.5.2 and 10.7.6.2 step into some details. As a consequence, the paragraph on microinsurance in lines 9-14 -- particularly addressed by the comment -- should simply introduce the concept, the current setting and the problems involved by correlated weather risks. The next subsections discuss the required details, e.g. public arrangements such as FONDEN or CCRIF, schemes linking insurance cover to credit in order to improve yield by better technology, index-based weather insurance concepts avoiding loss adjustment costs etc.. Other than the comment states, 10.7.4.2 has not a focus on private sector insurance - all paragraphs are of relevance to both publicly and privately organized systems, and also to PPP systems. Hence, wording within 10.7.4 has not been changed, but caption has been modified to "Fundamental Supply-Side Challenges and Sensitivities". This should better clarify what to expect from this subsection. See also above at comment no. 430. |
| 455 | 73155 | 10 | 25        | 49        | 25      | 49      | Replace "not economically prudent" with "not financially prudent for the uninsured". It may well be financially prudent for the insurance companies not to provide coverage. Do not confuse economically with financially. (UNITED STATES OF AMERICA)  | The comment's suggestion does not hit the point. The paragraph is about disaster risk financing and deals with options (such as external credit, donor assistance, etc.) to fill the financing gap that exists in middle- and low-income countries following a disaster. One of these options is a developed insurance market, that stabilises and increases output (GDP) while reducing sovereign deficit after weather-related disaster shocks, as was shown e.g. by Melecky and Raddatz, 2011. Hence, the perspective is truly economic and it is important to state that it is "not economically prudent" (for national economies of middle- and low-income countries) to not have sufficiently developed insurance systems (public of private systems).  |

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| 456 | 68095 | 10 | 25        | 49        | 26      | 1       | This paragraph fails to adequately reflect the limitations of insurance in climate change adaptation. For example, the rising insurance costs, the limited insurable climate change coverage. It is suggested to add in Line 1, Page 26 "Some countries are facing difficulties in obtaining insurance coverage to protect their assets against the adverse effects of climate, as the premium is increasing. The narrow scope of most of the current insurance schemes presents another hindrance to some countries effectively insuring their assets" (FCCC/SBI/2012/29,2012) (CHINA)   | The suggested discussion on limitations of insurance is partly met by the next paragraph, where we briefly discuss the hardship of these countries' insurance schemes to upscale their business, and to access risk-based capital (raised by the hazard level) in the international reinsurance market. -- However, the comment seems to specifically address limitations of sovereign insurance covering public assets. As this is still a relatively small branch of insurance (see the "primer" on this type of insurance by Ghesquiere and Mahul, 2010), there are only very few examples in operation (e.g. FONDEN, Mexico, and CCRIF, Caribbean, as a pooling arrangement - see the brief treatment in 10.7.5.2). A few more are at preparation or early implementation stage (African Risk Capacity, Pacific Catastrophe Risk Assessment and Financing Initiative, South East Europe and Caucasus Catastrophe Risk Insurance Facility). Although there might be even more sovereign insurance products somewhere existing, a broad review on strengths and limitations has not yet shown up in the research literature. However, a discussion on the efficiency of such concepts, including limitations, should be based on available literature. Hence, wording has not changed. |
| 457 | 71487 | 10 | 26        | 9         | 26      | 21      | The paper by Melecky & Raddatz 2011 (Reference: Melecky, M., Raddatz, C. (2011): How do governments respond after catastrophes? Natural-disaster shocks and the fiscal stance. World Bank. Washington D.C.) outlines how national economies respond to disaster losses and provides a useful analysis on the time that is necessary for economies with insurance to recover after a shock in comparison to those without insurance. This examples might be helpful to underline to overall benefit of employing insurance approaches with regard to GDP in the face of losses due to climate change risks. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS)) | Correct. Melecky and Raddatz, 2011, and also another study which supports the results of them based on partly different data (von Peter, von Dahlen, and Saxena, 2012), are important, but not so much in the context alluded to by the comment (pages 26, lines 9-12). Instead, this literature is cited in the discussions p.23, l.22-24 (10.7.2), p.25,l.51-53 (10.7.4.2).  |
| 458 | 71488 | 10 | 26        | 9         | 26      | 21      | The paper by Traerup 2012 (Reference: Traerup, S. L. M. (2012): Informal networks and resilience to climate change impacts: A collective approach to index insurance) provides a nice reflection on how to utilise informal networks as a means to distribute index-based insurance products in developing countries. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))  | Correct. However, here (p.26, l.9-14) we introduce fundamentals of microinsurance and the extension of such schemes to weather-risk cover. In 10.7.5.2 and Table 10-7 we discuss weather-index insurance schemes in more detail, and Traerup 2012 has been included there within the studies suggesting collective approaches for index insurance in order to reduce basis risk and misunderstanding (Table 10-7).   |
| 459 | 73156 | 10 | 26        | 14        | 0       | 0       | These donor-funded microinsurance projects are small-scale, mainly pilots. They are unlikely to be replicated on a large scale by the private sector and would be costly to expand through donor support. Most are limited to agricultural crop coverage. (UNITED STATES OF AMERICA)  | Agreed that most of these schemes are still at pilot stage and cover agricultural risks (crops). However, private sector engagement and potential success of scaling-up also depends on other factors, such as regulation and public involvement (e.g., through PPP arrangements or entirely organized via public arrangement). Driven by regulation, India has developed notable microinsurance coverage - as an example. See the extended discussion of index insurance in 10.7.5.2 together with Table 10-7. -- Given these facts there is no need to change the wording.   |
| 460 | 73157 | 10 | 26        | 17        | 0       | 0       | Replace "are" with "may be". (UNITED STATES OF AMERICA)   | Text revised   |

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| 461 | 71504 | 10 | 26        | 19        | 26      | 20      | Moral hazard and risky behavior is an issue for traditional indemnity based insurance schemes; the differentiation needs to be made here that moral hazard in parametric index insurance is reduced ProVention Consortium / IIASA review of microinsurance programs, Disaster Insurance for the Poor? A Review of Microinsurance for Natural Disaster Risks in Developing Countries, July 2006 (Sobiah Becker, Munich Climate Insurance Initiative, United Nations University)  | As moral hazard is a substantial challenge of existing insurance markets and, for instance, has been involved in various types of insurance including yield-based crop insurance systems (Coble et al., 1997; Makki and Somwaru, 2001; Glauber, 2004), it has to be included in the discussion of "challenges and sensitivities" in 10.7.4. Where index-based weather insurance comes into focus (10.7.5.2 and Table 10-7) it is clearly stated that moral hazard is avoided. Hence, the suggested message is already there and the wording has not been changed.  |
| 462 | 58640 | 10 | 26        | 24        | 0       | 0       | Section 10.7.5: The proposals for risk transfer systems are broadly ignoring the international ethical and equity dimension. It is well possible that developing countries cannot afford sovereign insurance. If this topic goes beyond the scope of this chapter, a reference to another chapter would be appropriate here. (Daniel Osberghaus, Centre for European Economic Research (ZEW))   | Correct - stepping into the ethical discussion would go beyond this section's scope and limited space. See also the discussion of sovereign insurance in Table 10-7 (last row). Without application to specific risk transfer topics such as sovereign insurance, chapter 16 introduces the fundamental role of ethical principles such as equity in various dimensions (see 16.6 - Ethical Dimension of Adaptation Constraints and Limits). A discussion on ethics at the limits of adaptation is provided in 16.6.2. Within chapter 10, the ethical dimension of adaptive risk transfer systems is particularly visible in 10.7.6.2, where the funding of the proposed adaptation regime of the UNFCCC, including risk transfer, is expected to be based on the principle of "equity and [...] common but differentiated responsibilities and respective capabilities".  |
| 463 | 73158 | 10 | 26        | 26        | 0       | 0       | Also, insurers often exclude coverage of certain types of climate-related risks and damage in residential and commercial real estate policies in the United States. (UNITED STATES OF AMERICA)  | Correct, refraining from offering coverage in high-risk areas is one of the options. This option is listed in Table 10-7 (p.70): "exclusion of systematically affected property."  |
| 464 | 80197 | 10 | 26        | 26        | 27      | 21      | Section 10.7.5 discusses products and systems responding to changes in weather risks. As previous comments, this section mostly talks about experience from the private sector. More literature and experience from public-private sector approaches must be added to provide a balanced view. The section seems to rely on the same few sets of authors (good, but more literature is available and should be tapped into). For section 10.7.5.1 please cite Swenja Surminski's 2011-2012 survey for ClimateWise of private sector insurance linked with prevention/disaster risk reduction measures (about 120 examples from developed countries). Look at Paul Kovac, Andrew Dlugolecki, Laurens Bouwer work on insurance in developed countries. Lines 43 (page 26) starts out by talking about commercial risk assessment models...is this the case for the rest of that paragraph? It seems like many of the factors names like geospatial information come from the public sector. More could be made of the Geneva Association's journal publications on climate risk and insurance (special issue in 2010 I believe, as well as a 2009 or 2010 book on the issue). (Koko Warner, United Nations University - Institute for Environment and Human Security) | Section 10.7.5.1 and 10.7.5.2 involve response options to changes in weather risks that are of relevance to public sector arrangements, to private sector arrangements, and to public-private partnership arrangements. For instance, this is obvious for basic principles around incentivizing policyholders to reduce vulnerability via risk-based premiums, for risk assessment and zoning technology (risk models, geospatial zoning tools), the role of reinsurance and risk transfer to the capital market (e.g. relevant for CCRIF, FONDEN), pros and cons of weather index insurance, and - last but not least - sovereign schemes such as FONDEN, CCRIF and others, which are public arrangements. Wording has been changed in 10.7.5.2. for middle- and low-income countries, where new peer-reviewed literature on the benefit/cost effect of retrofitted buildings in Caribbean islands (hurricane risk) has been included. See also above at comment no. 430. |

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| 465 | 71505 | 10 | 26        | 34        | 26      | 35      | Collaborative efforts of the public and private sector need to be embedded within a broader disaster risk reduction strategy which includes regulation as well as incentives and citizen oversight. (Sobiah Becker, Munich Climate Insurance Initiative, United Nations University)  | Although a broader risk reduction strategy including regulation, incentives and citizen oversight can be seen as an ideal overall framework, a condensed version of such an effort, viewed under the guiding question for options to reduce vulnerability, could be described as collaborative efforts of insurers and governments to decrease risk. In order to stress the incentive aspect mentioned by the comment, wording has been changed. Also the application of risk models to calculate the beneficial effects of vulnerability-reducing adaptation measures has been included. |
| 466 | 73159 | 10 | 26        | 37        | 26      | 38      | The point that risk-based premiums may be hampered by price regulation, subsidies, etc. seems important to emphasize. It would be useful to add a sentence or two more on the way this plays out in the market. An example illustrating this point would also be helpful. (UNITED STATES OF AMERICA)   | Wording has been changed to allow for more emphasis and explanation of mechanisms and effect (missing incentives to reduce vulnerability). Due to limited space no example could be detailed.   |
| 467 | 71489 | 10 | 27        | 24        | 27      | 40      | Section 10.7.5.: The authors could consider including examples such as the Caribbean Catastrophe Risk Insurance Facility (CCRIF), the Africa Risk Capacity (ARC), the South East Europe and Caucasus Catastrophe Risk Insurance Facility (SEE-CRIF), the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) to underline an increasing emphasis on approaches to tackle weather-related risks with (among other approaches) insurance solutions at a regional scale. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))   | CCRIF had already been briefly included in lines 38-40 and Table 10-7. In the meanwhile PCRAFI has established a specific insurance branch which is called Pacific Disaster Risk Financing and Insurance Program. The suggested schemes, while at early implementation or still at development stage, have been included in Table 10-7.   |
| 468 | 71490 | 10 | 27        | 24        | 27      | 40      | Section 10.7.5.: To also highlight the use of innovative technologies to address challenges of setting up index-based insurance solutions in developing country contexts (such as availability of weather data), the authors might consider mentioning examples such as the index-based cattle insurance in Kenya (IBLI: <a href="http://livestockinsurance.wordpress.com/">http://livestockinsurance.wordpress.com/</a> ) that uses the Normalised Vegetation Index (NDVI) via satellite to detect changes in forage availability as an indicator for loss of livestock. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS)) | Regarding such innovative technologies, Table 10-7 ("Improvements in index-based weather insurance") already states that basis risk "can be better absorbed [...] if satellite-based remote sensing technology can be used to establish plot identification, yield estimation and loss assessment." According to the comment's suggestion, we have included also the Kenyan example into Table 10-7..   |
| 469 | 71491 | 10 | 27        | 24        | 27      | 40      | The paper by Traerup 2012 (Reference: Traerup, S. L. M. (2012): Informal networks and resilience to climate change impacts: A collective approach to index insurance) gives some further examples on challenges of setting up index insurance in a developing country context. (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))  | The study by Traerup, 2012 promoting informal networks as the units to take out insurance is another example to support the statement in lines 31-33: "Suggested improvements include [...] coverage at aggregate level to reduce basis risk". The reference has been included in the more detailed discussion within Table 10-7.   |

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| 470 | 73160 | 10 | 27        | 26        | 27      | 36      | The description of how index-based weather insurance may work and why it reduces moral hazard and adverse selection is a bit opaque. It may make sense to expand this section a bit to add some explanation. How are adverse selection and moral hazard removed? (UNITED STATES OF AMERICA)   | In order to better explain why moral hazard and adverse selection -- capable of causing markets to fail -- are changed, wording has been modified - "Payouts depend on a physical trigger, e.g. cumulative rainfall at a nearby weather station, instead of the insured's condition. Thus costly loss assessments and moral hazard are avoided, adverse selection reduced". This wording should have clarified that the insured's condition (that might materialize moral hazard or adverse selection) cannot have any manipulative influence on the payout and thus on the financial stability of the scheme. However, as the most recent literature (Chantararat et al., 2013) presents an example of possible adverse selection in the special case of index-based livestock insurance, wording in regard to adverse selection has been changed to "reduced" instead of "removed". Due to limited space, the discussion in 10.7.5.2 has to be brief, but is extended in Table 10-7 to include more detail on spatial distribution, main products, suggestions for improvements of basis risk, etc.. |
| 471 | 76832 | 10 | 27        | 43        | 0       | 0       | Closing the Financial Gap: Public-Private Innovations in Disaster Risk Financing<br><a href="http://media.swissre.com/documents/pub_closing_the_financial_gap_W1.pdf">http://media.swissre.com/documents/pub_closing_the_financial_gap_W1.pdf</a> (Lea Mueller, Swiss Reinsurance Company Ltd)  | Interesting private company brochure on PPP etc. including some business examples.   |
| 472 | 58630 | 10 | 27        | 45        | 28      | 5       | In the cited literature, there is more information (and evaluation) on the different insurance regimes, e.g. regarding the equity/efficiency trade-off and incentives for individual precaution. Elaborating a bit more on the strengths and weaknesses of each mentioned regime would be helpful for the reader. (Daniel Osberghaus, Centre for European Economic Research (ZEW))  | Due to strict space constraints, only a brief and summarizing selection of the potentially available information and discussion can be presented. Somewhat more information is presented in Table 10-8.  |
| 473 | 71492 | 10 | 28        | 21        | 28      | 21      | "In least developed countries, even incipient domestic insurance markets hardly exist." - to further specify this point, the authors might consider including at the end of the sentence an addition such as "..., including a lack of understanding of the different usages for the tool of insurance in general, let alone specific regulations to develop said markets." (Michael Zissener, United Nations University Institute for Environment and Human Security (UNU-EHS))  | The lack of regulation which would be needed to develop those markets is already mentioned in lines 16-17 (p.28). Further on, given that "even incipient domestic insurance markets hardly exist" as stated in line 21, it goes without saying that also knowledge about the wealth of potential insurance applications does not exist. Hence, wording has not been changed.   |
| 474 | 68096 | 10 | 28        | 21        | 28      | 26      | "AOSIS, 2008", "Swiss Confederation" and (MCII, 2008) are all submissions by relevant countries or group of countries to the UNFCCC Secretariat. Having not been peer reviewed, they should not be cited as literature. In addition, Table 10-8 also refers to these proposals. It is suggested to delete such a reference and any conclusion arising therefrom. (CHINA)  | The comment correctly states that the submissions per se are non-peer-reviewed material. On the other hand, the research literatures is viewing these submissions as sources for concepts that can be analysed and discussed from a pure research perspective. As a consequence, the submissions referenced are deleted from the text, the reserach literature dealing with those submissions is kept in the text. The paragraph is purely descriptive and analytical, no conclusion for policy is arrived at.   |
| 475 | 71506 | 10 | 28        | 28        | 28      | 29      | Innovative insurance solutions have a role to play in managing loss and damage associated with extreme weather events and the potential role of a range of insurance-related approaches that transfer risk in the context of loss and damage, and climate change adaptation. Warner, K et al (2012) Insurance solutions in the context of climate change-related loss and damage: needs, gaps and roles of the convention in addressing loss and damage. Munich Climate Insurance Initiative. (Sobiah Becker, Munich Climate Insurance Initiative, United Nations University) | It is not fully clear what the comment is suggesting. Wording has not been changed.  |
| 476 | 73161 | 10 | 28        | 40        | 0       | 0       | Distinguish between government's share of the economy in high income, middle income and low income countries. (UNITED STATES OF AMERICA)  | statement is intended for general introducdtion, not to be specific by income, not imply a finding.  |

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| 477 | 61234 | 10 | 28        | 43        | 28      | 50      | Section 10.8.1. What did the listed studies conclude? What were the impacts on retail for example? Please amend. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | Text revised  |
| 478 | 73162 | 10 | 29        | 3         | 30      | 24      | Most of the health discussion is on malnutrition, diarrheal diseases, and malaria. Are there other health impacts from climate change that could be briefly discussed in this section, even if there isn't much quantitative literature on them - e.g., increase heat related deaths and decrease in cold related deaths? Also, reference the health chapter and make sure this discussion is consistent with it. (UNITED STATES OF AMERICA)  | The United States is correct there are many other health impacts of climate change, such as increasing mortality due to high ambient temperatures. That literature is assessed in Chapter 11. This chapter focuses on what literature is available on the economic consequences for the health sector, such as demand for services. |
| 479 | 73163 | 10 | 29        | 12        | 29      | 13      | 600,000 worldwide? Per year or total over the period? Number seems low for a worldwide total for the whole period. (UNITED STATES OF AMERICA)   | The number of people affected in hydrologic disasters in 2011 is provided instead.  |
| 480 | 84619 | 10 | 29        | 15        | 29      | 15      | Please provide reference to a specific section of Chapter 11. (Michael Mastrandrea, IPCC WGII TSU)  | 11.4.1; 11.4.2  |
| 481 | 73164 | 10 | 29        | 16        | 29      | 17      | Delete or support with citations the assertion that people are going to the hospital just to get into an air-conditioned location. Heat stress and heat stroke exacerbates cardiac and other physiological problems that manifest in serious symptoms. (UNITED STATES OF AMERICA)   | Citation is provided (Carthey et al. 2009). Sentences reworded and reordered to clarify reasons for hospitalizations.   |
| 482 | 69097 | 10 | 29        | 16        | 29      | 19      | The correlation between rise in temperature and hospital visits as worded here makes it seem as if people are going to hospitals to get air-conditioning. We do not believe that this is the intention of the argument. A suggested reword - "High ambient temperatures can also lead to increased hospital visits due to heat-related illnesses. The example that follows from Rising et al. 2006 about the temperature change relationship with hospital admissions then is relevant. However, the inclusion of the link between increases in hospital admission and changes in precipitation needs to be further explained and linked to the temperature change and hospital admissions argument, or it could be removed altogether. (NETHERLANDS) | Sentences reworded to clarify point.  |
| 483 | 63236 | 10 | 29        | 25        | 29      | 26      | Rather than increase the burden ... malaria ... write influence the burden : 1) Mordecai, Erin A, Paaijmans, Krijn P, Johnson, Leah R, Balzer, Christian, Ben-Horin, Tal, de Moor, Emily, McNally, Amy, Pawar, Samraat, Ryan, Sadie J, Smith, Thomas C, Lafferty, Kevin D, and Thrall, Peter: Optimal temperature for malaria transmission is dramatically lower than previously predicted., Ecol Lett, 2013 2) Lunde, Torleif Markussen, Bayoh, Mohamed Nabie, and Lindtjorn, Bernt: How malaria models relate temperature to malaria transmission., Parasit Vectors 6(1), 20, 2013 (Torleif Markussen Lunde, University of Bergen)  | Thank you for the references. This section is not a review of the potential impacts of climate change on the burden of malaria. The reader is referred to Chapter 11 for their assessment.  |
| 484 | 84620 | 10 | 29        | 26        | 29      | 26      | Please provide reference to a specific section of Chapter 11. (Michael Mastrandrea, IPCC WGII TSU)  | Chapter 11.5.1; 11.5.2; 11.6.1  |
| 485 | 73165 | 10 | 29        | 28        | 0       | 0       | Add anti-malarials before oral rehydration. (UNITED STATES OF AMERICA)  | Change made   |
| 486 | 73166 | 10 | 29        | 34        | 0       | 0       | Billions of dollars is very unpecific. Can the actual range of numbers be listed? Can it be disaggregated across high, middle, and low income countries? What are the current global expenditures on health care as the baseline? (UNITED STATES OF AMERICA)  | The ranges are provided in the study summaries. There are too few studies and too many uncertainties to defensibly disaggregate into low-, middle-, and high-income countries. Information on current expenditures moved to a new paragraph.  |
| 487 | 69098 | 10 | 29        | 39        | 29      | 39      | The inclusion of information on what \$4 - 12 billion worldwide is in terms of percentage global GDP could strengthen this argument. It would help to illustrate the significance of the impact of climate change on health. (NETHERLANDS)  | The study did not estimate global GDP in 2030. Using estimates from other sources would introduce more uncertainty as to assumptions.   |
| 488 | 69099 | 10 | 29        | 44        | 29      | 47      | References are a bit outdated. (NETHERLANDS)  | 2003 reference removed. Other reference is to the baseline used in the study Ebi used.  |
| 489 | 73167 | 10 | 29        | 45        | 29      | 47      | 2002 data for development assistance in health/2004 baseline data are too old. More recent data are available (WHO). (UNITED STATES OF AMERICA)   | New data added for development assistance for health. 2004 baseline is what was used in cited study.  |
| 490 | 73168 | 10 | 30        | 4         | 30      | 24      | A table summarizing the findings of the main studies in health would be useful. (UNITED STATES OF AMERICA)  | space does not allow  |
| 491 | 82431 | 10 | 30        | 7         | 30      | 7       | Is the percentage given for the low or high-cost scenario? It would probably be clearest to the relevant percentage for both scenarios here. (Katharine Mach, IPCC WGII TSU)  | Paper unclear; deleted.   |
| 492 | 73169 | 10 | 30        | 8         | 0       | 0       | Is this percent of GDP based on the low or high cost of treatment estimate? (UNITED STATES OF AMERICA)  | Paper unclear; deleted.   |
| 493 | 73170 | 10 | 30        | 18        | 30      | 20      | The WHO 2004 conclusion may no longer be correct as a result of the President's Malaria Initiative. Please find more recent information. (UNITED STATES OF AMERICA)   | No more recent publications identified.   |

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| 494 | 73172 | 10 | 30        | 24        | 0       | 0       | Why discuss cholera and not AIDS and TB, which are far more costly? Look further for any literature on climate impacts on AIDS and TB treatment costs and longevity. (UNITED STATES OF AMERICA)  | Such literature is very much needed. Perhaps the US would be willing to fund such research?  |
| 495 | 63237 | 10 | 30        | 24        | 30      | 24      | It should be made clear the estimates for malaria only apply to India (Torleif Markussen Lunde, University of Bergen)  | Change made.   |
| 496 | 73171 | 10 | 30        | 24        | 30      | 24      | Cost estimate in local currency is inconsistent with other estimates throughout the chapter that report in USD or percent of GDP, and is difficult to scale for most readers. (UNITED STATES OF AMERICA)   | This paper did not report results in USD or as percent of GDP. Estimating exchange rates in 2030 would introduce considerable additional uncertainty.  |
| 497 | 63574 | 10 | 30        | 27        | 32      | 52      | This chapter is mainly characterized by a neo-classical view on Markets and Development (mainly focusing on market adjustments by price signals). Please add considerations as for institutional design, regulation and governance of markets. (GERMANY)   | See comment 503.   |
| 498 | 73173 | 10 | 30        | 31        | 0       | 0       | List the types of indirect impacts covered in the next section here. (UNITED STATES OF AMERICA)  | rephrased  |
| 499 | 61235 | 10 | 30        | 34        | 31      | 30      | Section 10.9.1. General Equilibrium Effects. CGE models are not the only ones being able to look at the economy wide impacts. There are other models that can study this for example extended input-output models (see, Hallegatte 2008, in chapter 17), multi-reigonal input-output models, econometric models. CGE models can look at the inter-sectoral effects mainly because they incorporate input-output tables. The other methods should mention here too. The chapter should be renamed to Economy wide impacts or something similar. The other issue with this section is that it lists CGE studies (page 31 lines 1-9, without discussing the results. This section should be amended (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit) | First comment: CGE downplayed. Section now starts with mechanisms. See also comment 503. Second comment: Results are discussed towards the end of the section.   |
| 500 | 65951 | 10 | 30        | 34        | 31      | 30      | The section should discuss the role of adaptation of critical infrastructure in relation to growth and in the general equilibrium. That has got some attention by the World Bank and other Organizations (e.g. Satterthwaite, D. (2007) Adaptation options for infrastructure in developing countries, The Rockefeller Foundation). There are references in the Stern Report, and in Agrawala, S. & Fankhauser, S. (2008) Economic Aspects of Adaptation to Climate Change, OECD. (Klaus Eisenack, Carl von Ossietzky University Oldenburg)  | References are all to gray literature.   |
| 501 | 73174 | 10 | 30        | 41        | 0       | 0       | Add: and/or consumers would substitute lower-cost foods or grow more food. (UNITED STATES OF AMERICA)  | Added.   |
| 502 | 73175 | 10 | 30        | 42        | 30      | 43      | Labor is not the only input that may be increased - fertilizer and irrigation use might go up. (UNITED STATES OF AMERICA)  | Added.   |
| 503 | 73176 | 10 | 30        | 49        | 30      | 49      | Given that partial equilibrium models can not capture interactions across sectors, delete the "more realistic" in this sentence, or making it clear that this pertains to its representation of a particular sector, not overall. (UNITED STATES OF AMERICA)   | Combined with comment 499. Text now says "Other types of economic models have yet to be applied to the estimation of indirect economic effects of climate change." Specific reference to partial equilibrium models removed. |
| 504 | 73177 | 10 | 31        | 11        | 31      | 13      | Tourism dominated the welfare effects, compared to what? What geographic region was this study (Bigano et al (2008b), concerned with? Avoid over-generalizing across different locations and contexts. (UNITED STATES OF AMERICA)  | Clarified.   |
| 505 | 73178 | 10 | 31        | 17        | 31      | 19      | Combined impact of what and over what period of time? Is this historical or a future projection? Numbers are not meaningful unless the assumed global temperature increase and time period are specified. (UNITED STATES OF AMERICA)   | Clarified.   |
| 506 | 73179 | 10 | 31        | 20        | 31      | 30      | This paragraph of initial conclusions based on the existing evidence is great. Please include a conclusion organized in similar fashion for each of the main economic sectors discussed. This will help the reader understand what the main take-aways are from the myriad of very specific studies. (UNITED STATES OF AMERICA)  | Recommended to other LAs.  |
| 507 | 82432 | 10 | 31        | 21        | 31      | 30      | For these conclusions, calibrated uncertainty language should be provided to characterize the author team's degree of certainty in the findings. Levels of confidence or summary terms for evidence and agreement may be particularly appropriate. (Katharine Mach, IPCC WGII TSU)   | These are logical cq qualitative statements.   |
| 508 | 73180 | 10 | 31        | 37        | 31      | 37      | If our understanding is limited, then "could" (or even "is likely to?") is more appropriate than "would". Please revise the text accordingly. (UNITED STATES OF AMERICA)   | Replaced "would" with "will"   |



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| 509 | 60006 | 10 | 31        | 37        | 31      | 50      | This paragraph makes little sense and does not follow a clear line of argument. The point that the authors are trying to make is not evident. In addition, the conclusion that Australia's GDP would increase by +0.4% in 2050 as a result of climate change impacts is inconsistent with macroeconomic modeling done for Australia. In the only comprehensive macroeconomic modeling exercise on the impacts from climate change done for Australia, Garnaut (2008 - The Garnaut Climate Change Review: Final Report © Commonwealth of Australia 2008, Cambridge University Press, <a href="http://www.garnautreview.org.au/index.htm">http://www.garnautreview.org.au/index.htm</a> ) concluded that Australia may see GDP fall from the reference case by about 4.5% by 2100 (pg 213 of report). (AUSTRALIA)  | Paragraph edited for clarity. Garnaut added.  |
| 510 | 71346 | 10 | 31        | 47        | 31      | 47      | Suggest giving consideration to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)  | Absolute impacts cannot be interpreted without adding information on the scale of the economy.  |
| 511 | 73181 | 10 | 31        | 52        | 31      | 53      | An 11-27% decrease in labor productivity is very large. More explanation is needed on the assumptions in this study. (UNITED STATES OF AMERICA)  | We now refer to Ch 11 (health) where this study is discussed in more detail.  |
| 512 | 82433 | 10 | 31        | 52        | 31      | 53      | For this projection, the relevant scenario of climate change should be specified. (Katharine Mach, IPCC WGII TSU)  | Added.  |
| 513 | 61236 | 10 | 31        | 52        | 32      | 3       | An interesting and important point about losses in labour productivity due to changes in climate (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | Thank you   |
| 514 | 78931 | 10 | 32        | 14        | 0       | 0       | Section 10.9.2.2. In the first paragraph of this section, authors introduced a controversial idea on climate-poverty relationship which should not be included as part of the review for this section. This section must be focused on how poverty may become an obstacle to the achievement of adaptation measures to climate change. Therefore, this first paragraph must be obliterated from the document. (VENEZUELA, BOLIVARIAN REPUBLIC OF)  | 1) Subject was in plenary approved outline. 2) The impact of development on adaptation is discussed in other chapters. 3) We assess the academic literature to inform government decision making. |
| 515 | 80198 | 10 | 32        | 14        | 49      | 0       | Several new case studies in 2012 (forthcoming in journals) have noted the links between climatic stressors and poverty. These could be mentioned in this section to bolster the confidence and evidence base. For example, Kusters and Wangdi (2013) find that changes in water availability in Bhutan increase the poverty of farmers (Kusters, K. & N. Wangdi (2013). The costs of adaptation: Changes in water availability and farmers' responses in Punakha district, Bhutan. Int. J Global Warming, Vol. X, No. x, pp. xx-xx.); Opondo finds that people in Kenya have an eroded development base in relation to their negative coping (Opondo, D. (2013). Erosive coping after the 2011 floods in Kenya. Int. J Global Warming, Vol. X, No. x, pp. xx-xx.); Yaffa (2013) finds that poverty deepens in relation to drought in the North Bank region of the Gambia (Yaffa, S. (2013). Coping measures not enough to avoid loss and damage from drought in the North Bank Region of The Gambia. Int. J Global Warming, Vol. X, No. x, pp. xx-xx.); and Traore et al. (2013) find that drought-related livestock and crop loss increase poverty in Northern Burkina Faso (Traore, S., T. Owiyo & Y. Sokona (2013). Dirty drought causing loss and damage to livestock and crops in the Sahel region, Northern Burkina Faso. Int. J Global Warming, Vol. X, No. x, pp. xx-xx.), and Lashley and Warner (2013) find that current coping mechanisms vis-a-vis excess rain and wind in St. Lucia, Grenada, Jamaica, and Belize reduce income and livelihood security of already-low income people (Lashley, J., Warner, K. 2013. Evidence of implicit and explicit demand for weather-related microinsurance in the Caribbean. Climatic Change. Special Issue "Advancing Climate Adaptation and Risk Management. New Insights, Concepts and Approaches" (Birkmann, Mechler editors). (Koko Warner, United Nations University - Institute for Environment and Human Security) | Papers could not be found. Judging from their titles, the first four are about weather, not climate; the last one is about adaptation. All five are perhaps better placed in a regional chapter.  |
| 516 | 65051 | 10 | 32        | 16        | 32      | 17      | The statement about the causes of poverty is weakly supported (just one reference) and provides no basis for contextualizing poverty traps into climate change. I suggest removing this sentence. (Meimalin Moreno, Instituto Venezolano de Investigaciones Cientificas)   | Nine studies are cited in the paragraph.  |
| 517 | 78929 | 10 | 32        | 16        | 32      | 17      | The statement about the causes of poverty is weakly supported (just one reference) and provides no basis for contextualizing poverty traps into climate change. I suggest removing this sentence. (VENEZUELA, BOLIVARIAN REPUBLIC OF)  | Nine studies are cited in the paragraph; see comment 516  |
| 518 | 69100 | 10 | 32        | 33        | 32      | 37      | This section seems a bit farfetched and is making unsubstantiated, and what really seems like unreasonable claims for the impact of climate change on poverty. It needs rewording to make sense using expressions such as 'contribute to' as poverty is often the effect of multiscale and temporal drivers. A suggested rewording is given in the comment below. (NETHERLANDS)  | Rephrased: lead > contribute; would > could   |
| 519 | 69101 | 10 | 32        | 34        | 32      | 35      | Suggested reword 'This can contribute to their being in state of poverty in their later life, and limited ability to protect their own children against these diseases.' to replace 'This leads to poverty...against these diseases.' (NETHERLANDS)  | Agreed.   |
| 520 | 77181 | 10 | 32        | 36        | 0       | 0       | correct morbidity in morbidity (ITALY)   | rejected  |

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| 521 | 73182 | 10 | 32        | 37        | 32      | 11      | There is also some literature on post-disaster GDP losses that may be worth mentioning in this section -- on short-run GDP response (eg. Stromberg (JEP, 2007); Noy (JDE, 2009); Hsiang (PNAS, 2010)), Long-run GDP response via cross-sectional correlation (eg. Skidmore and Toya (Econ. Inq., 2002)), Long-run GDP response via self-reported losses (eg. Raddatz (2009), Cavallo et al. (2010)). UN & World Bank (2010); Cavallo & Noy (RERE, 2011); Kellenberg & Mobarak (ARRE, 2011); IPCC (2012)). (Full references for these can be found in Antilla-Hughes and Hsiang. 2011. Destruction, Disinvestment, and Death: Economic and Human Losses Following Environmental Disaster. WP, <a href="http://www.solomonhsiang.com/research/publications">http://www.solomonhsiang.com/research/publications</a> .) Other: Hornbeck, R. 2009. The Enduring Impact of the American Dust Bowl: Short and Long-Run Adjustments to Environmental Catastrophe. Working Paper 15605. Cambridge, MA: National Bureau of Economic Research. Kousky, C. 2012. Informing Climate Adaptation: A Review of the Economic Costs of Natural Disasters, Their Determinants, and Risk Reduction Options. RFF Discussion Paper July 2012 12-28. (UNITED STATES OF AMERICA) | Added references to Cavallo et al., Skidmore and Toya, and Raddatz. Stromberg is off-topic. Kellenberg & Mobarak and Cavallo & Noy are review papers, largely silent on climate change. Hsiang paper is about weather not climate. |
| 522 | 69102 | 10 | 32        | 42        | 32      | 43      | Perhaps the relationship between natural disasters and the economic growth rate is expounded in other chapters, and if this is the case this should be cross-referenced. If not, then this relationship should be expounded here. (NETHERLANDS)  | See response to comment 521.   |
| 523 | 59466 | 10 | 33        | 0         | 34      | 0       | The research priorities should include interdisciplinary research efforts from various starting points in order to reach an economically viable and sustainable future. (Denia Kolokotsa, Environmental Engineering Department, Technical University of Crete, Greece) (GREECE)  | Overly prescriptive  |
| 524 | 61237 | 10 | 33        | 1         | 33      | 7       | The conclusions could be more explicit on the reasons in the divergence of the results. In particular, the role played by the modelling of extreme weather events should be clearly spelled out. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)   | The conclusion highlights the disagreement. The preceding text makes clear that this is because of a number of reasons, extreme events being a minor component.  |
| 525 | 69103 | 10 | 33        | 4         | 33      | 4       | The preceding sections suggest that climate change would affect economic growth differently in different regions, though generally negatively. It would thus be more accurate to add the words "global average" to this sentence as follows: "There is agreement that climate change would slow global average economic growth". (NETHERLANDS)   | Added: Different economies will be affected differently.   |
| 526 | 82434 | 10 | 33        | 4         | 33      | 7       | For these statements, calibrated uncertainty language should be used to characterize the author team's degree of certainty in the findings. Levels of confidence or summary terms for evidence and agreement may be particularly appropriate. (Katharine Mach, IPCC WGII TSU)  | These are logical cq qualitative statements.   |
| 527 | 61238 | 10 | 33        | 10        | 33      | 53      | The research needs section should be much more specific on the need to take into consideration the impacts of extreme weather events when assessing the consequences of climate change. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | added  |
| 528 | 61239 | 10 | 33        | 10        | 34      | 4       | Section 10.1. Research needs and priorities. Points out research gaps and that there are high uncertainties related to economic impacts of climate change (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)  | Thank you.   |
| 529 | 77182 | 10 | 33        | 32        | 33      | 34      | This is not entirely correct. While there may be a dearth of studies tracking down explicitly climate change impacts on water-dependent sectors, studies based on computable general equilibrium models having water and /or water services among the primary and/or intermediate production factors are able to characterise indirect impacts across all sectors for which water enters the production function. For a survey of water integration into general computable equilibrium models, see: Roberto Ponce & Francesco Bosello & Carlo Giupponi, 2012. "Integrating Water Resources into Computable General Equilibrium Models - A Survey," Working Papers 2012.57, Fondazione Eni Enrico Mattei. (ITALY)  | Thank you. Only a few studies do so as noted.  |
| 530 | 67869 | 10 | 33        | 42        | 33      | 49      | This paragraph should be incorporated in the SPM because it shows the current limitation of knowledge about the climate change. This part is very important to show the necessity of research in this area to cope with the climate change toward the future. (JAPAN)  | Thank you. Wording has changed in the meanwhile for the sake of clarity. The rubric on research needs has its expected place within the chapter, where the detailed information should be provided.                                |
| 531 | 69104 | 10 | 34        | 0         | 0       | 0       | FAQ addition: Can we quantify the impact of the climate change signal on economic sectors, i.e. Can we model how economic sectors would react had climate change not been occurring? (NETHERLANDS)   | Out of scope   |
| 532 | 73183 | 10 | 34        | 2         | 34      | 4       | Impacts of climate change on economic growth is not well understood. It would be useful to attempt to characterize the climate and growth linkages/feedbacks in some IAMs, perhaps just directionally in a table to give readers a sense of the dynamics. (UNITED STATES OF AMERICA)   | Chapter reviews relevant literature.   |
| 533 | 65412 | 10 | 34        | 7         | 34      | 7       | FAQs should cover more aspects of the chapter than at present (John Hay, University of the South Pacific)  | TSU allows only few FAQs   |

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| 534 | 81249 | 10 | 34        | 9         | 0       | 0       | FAQ 10-1 The answer can be much shorter because essentially it is just saying that energy, water and health services demand and supply will change due to climate change. Recreation areas will also change due to changes in temperature. Any particular reason why these sectors have been used? if there is, then perhaps that could be explained in the answer. (Monalisa Chatterjee, IPCC WGII TSU)  | rephrased  |
| 535 | 81250 | 10 | 34        | 23        | 0       | 0       | FAQ 10-2 An interesting question would be - how is the financial services sector changing or will change to adjust to changing risks from climate change? (Monalisa Chatterjee, IPCC WGII TSU)  | For the insurance part of the financial services sector, measures of adaptation have been discussed in 10.7. In the meanwhile, another subsection on the financial services sector (apart from insurance) has been included and FAQ 10-2 accordingly reworked. |
| 536 | 63575 | 10 | 34        | 23        | 34      | 28      | Facing the present instabilities of the financial system this FAQ should additionally consider climate change impacts on the finance sector (overall - not only insurance). At least as need for further research. Possible literature on further needs: <a href="http://www.cfi21.org/fileadmin/user_upload/CSC-Bericht_englisch_web.pdf">http://www.cfi21.org/fileadmin/user_upload/CSC-Bericht_englisch_web.pdf</a> (GERMANY)  | According to the comment's suggestion, another subsection on the financial services sector (apart from insurance) has been included.   |
| 537 | 81251 | 10 | 34        | 30        | 0       | 0       | FAQ 10-3 An interesting question would be - how impact from one sector can spill over to other sectors. Examples in the answer will be very useful. (Monalisa Chatterjee, IPCC WGII TSU)  | Thank you. Examples in chapter   |
| 538 | 73184 | 10 | 35        | 9         | 35      | 10      | What is the increase in biofuel production for transport associated with the projected increase in water consumption? (UNITED STATES OF AMERICA)  | included IEA Biofuels numbers in revision.   |
| 539 | 77183 | 10 | 35        | 17        | 35      | 26      | These concepts are not clearly mentioned in section 10.2 on energy. Consider cross-referencing. (ITALY)   | noted and included now in 10.2   |
| 540 | 73185 | 10 | 35        | 22        | 35      | 22      | 40% of total energy use is for pumping groundwater. The figure seems implausibly high - is this referring to total primary energy, energy used for water-related activities, or something else? (UNITED STATES OF AMERICA)  | revised.   |
| 541 | 73186 | 10 | 39        | 17        | 60      | 44      | There are some duplicate citations. This occurs several times throughout the chapter. See 10.2 Energy, Page 10, line 5 and line 25 as an example. Some citations are not in the reference list. See 10.3 Water, Page 12, line 36 as an example. Will the 2013 references be available by the time the document is made public? (UNITED STATES OF AMERICA)   | noted, revised.  |
| 542 | 69105 | 10 | 41        | 1         | 41      | 4       | References Berrittella 2006a and Berrittella 2006b are identical. (NETHERLANDS)   | noted, revised.  |
| 543 | 77184 | 10 | 41        | 10        | 41      | 10      | If the authors intend to further explore the differences in approaches mentioned in my third comment above, please add here Bigano, A., Hamilton, J.M., Maddison, D.J., and Tol, R.S.J. (2006), "Predicting Tourism Flows under Climate Change", An Editorial Essay, Climatic Change, Vol. 79, N. 3-4. (ITALY)  | noted.   |
| 544 | 69106 | 10 | 41        | 13        | 41      | 16      | References Bigano 2008a and Bigano 2008b are identical. (NETHERLANDS)   | noted, revised.  |
| 545 | 77185 | 10 | 41        | 13        | 41      | 16      | Same paper cited twice, first as (Bigano et al. 2008a), then as (Bigano et al. 2008b). Drop one of the two references, and correct all references in the paper to (Bigano et al, 2008) (ITALY)  | noted, revised.  |
| 546 | 69107 | 10 | 45        | 5         | 45      | 8       | References Eboli 2010a and Eboli 2010b are identical. (NETHERLANDS)   | noted, revised.  |
| 547 | 69108 | 10 | 49        | 7         | 49      | 11      | Change reference years, respectively, in '2010a', '2010b' and '2010c'. (NETHERLANDS)  | noted, revised.  |
| 548 | 77186 | 10 | 49        | 14        | 49      | 15      | Insert reference for IEA, 2012b: Energy Technology Perspectives 2012. Organization for Economic Cooperation and Development/International Energy Agency, Paris, France. Correct previous reference to IEA 2012a. By the way, all references to IEA end with ", ." please remove comma (ITALY)   | noted, revised.  |
| 549 | 69109 | 10 | 50        | 12        | 50      | 15      | References Kjellstrom 2009a and Kjellstrom 2009b are identical. (NETHERLANDS)   | noted, revised.  |
| 550 | 69110 | 10 | 58        | 42        | 58      | 45      | References TRB 2008a and TRB 2008b are identical. (NETHERLANDS)   | noted, revised.  |
| 551 | 77187 | 10 | 61        | 0         | 0       | 0       | Table 10.1. Insert in Table impacts on energy demand through climate-change-induced migration and on supply through increased political instability, disruption of oil & gas exploration and refining activities by increasing occurrence of extreme weather events. Mention IEA 2012b among the sources. (ITALY)   | CC-induced migration is a relatively minor indirect impact. Political instability is covered in the Safety chapter. No change.   |
| 552 | 82435 | 10 | 61        | 0         | 0       | 0       | Table 10-1. For this table, it would be preferable to provide footnotes within the entries so that the reader can understand which underlying sources are relevant. As is, the traceability of the information for an interested reader is limited. Additionally, for the 1st entry within the "possible impacts" column, the relevant time frame or scenario could be clarified for the percentages given, so they can be better understood with respect to the capacity loss estimates given. For the 2nd entry under "possible impacts," the relevant time frame for these estimates could be clarified. (Katharine Mach, IPCC WGII TSU) | numbers were deleted in response to review comments on earlier draft. Impacts indicated general relationships rather than scenario results or time horizons. No change.  |

| #   | ID    | Ch | From Page | From Line | To Page | To Line | Comment   | Response  |
|-----|-------|----|-----------|-----------|---------|---------|---|---|
| 553 | 65852 | 10 | 63        | 0         | 0       | 0       | table 10.3 is confusing as it has too many numbers and possibilities. Authors may wish to create another column for short term /long term actions (Milton Nogueira da Silva, Climate Change Forum of Minas Gerais, Brazil)  | No Change. Other reviewers have suggested adding significantly to this table. The results are mostly all long-term, so a short-term/long-term distinction would be of little help since very little would be in the short-term column   |
| 554 | 81407 | 10 | 63        | 0         | 0       | 0       | Table 10-2: Please spell out CC and EWEs in the caption (Yuka Estrada, IPCC WGII TSU)   | Text Revised.   |
| 555 | 82436 | 10 | 63        | 0         | 0       | 0       | Table 10-2. For this table, it would be preferable to provide footnotes within the entries so that the reader can understand which underlying sources are relevant. As is, the traceability of information for an interested reader is limited. (Katharine Mach, IPCC WGII TSU)   | numbers were deleted in response to review comments on earlier draft. Impacts indicated general relationships rather than scenario results or time horizons. No change.   |
| 556 | 80396 | 10 | 64        | 0         | 0       | 0       | Tables 10-3 and 10-5: It would be good to put the results from climate change projections used as the basis for these impacts results into perspective with what WGI AR5 will be providing as for 21st century projections. This would also help ensure that inconsistencies between WGI AR5 assessment and individual studies cited in these tables can be avoided. (Gian-Kasper Plattner, IPCC WGI TSU) | No change. Studies do not consistently/adequately provide climate scenario information.   |
| 557 | 71347 | 10 | 64        | 0         | 64      | 0       | With respect to Table 10-3, suggest giving consideration to including the \$ level impacts in addition to the % Change in GDP. Providing only the % change does not provide a sense of impact implied. (CANADA)   | No Change. 1) Converting to \$ will provide a distorted sense of impact, especially in small and developing countries 2) the additional details will make the text less readable  |
| 558 | 82437 | 10 | 66        | 0         | 0       | 0       | Table 10-4. If studies of insured losses are available for any other regions of the world, beyond those characterizing the table, it would be preferable to expand the geographic scope of information provided. (Katharine Mach, IPCC WGII TSU)  | The intention was to collect and present all available studies on observed time series of INSURED losses from weather-related hazards since IPCC AR4. Corresponding to insurance penetration, all studies cover high-income countries, resulting in an economically (and geographically) very uneven country distribution. But it seems also important do present the very fact of this unevenness. |
| 559 | 73187 | 10 | 67        | 0         | 0       | 0       | Table 10-5: This table is very confusing. What is reported in this table? Are the changes in the third column changes in prices? In estimates of loss? And what are the non-percentages in the row for winter storms? There is no hint on what these numbers mean or how to interpret them. (UNITED STATES OF AMERICA)  | Table has been completely reworked.   |
| 560 | 82438 | 10 | 67        | 0         | 0       | 0       | Table 10-5. It would be helpful to clarify the information provided for "RP shifts." For example, within the 3rd row of the table, or in the last row on page 67, the statistics provided could be clarified. (Katharine Mach, IPCC WGII TSU)   | Table has been completely reworked.   |
| 561 | 82439 | 10 | 69        | 0         | 0       | 0       | Table 10-6. It would be preferable to improve the geographic balance of examples provided in this table, as can be supported by the literature. Is there information for high income countries beyond the US? (Katharine Mach, IPCC WGII TSU)   | Table has been modified in order to include an example of relevance for middle- and low-income countries, thus slightly improving the balance.  |
| 562 | 65052 | 10 | 73        | 0         | 0       | 0       | Figure 10-1. This figure does not show any pattern that allows relating the annual mean average temperature and the GDP per capita in order to explain variations in energy demand. The source of this figure (Toth, 2013) is a reference unpublished. (Meimalin Moreno, Instituto Venezolano de Investigaciones Cientificas)   | Figure 10.1 deleted.  |
| 563 | 65853 | 10 | 73        | 0         | 0       | 0       | Figure 10.1 needs explanation of what it means for climate analysis. (Milton Nogueira da Silva, Climate Change Forum of Minas Gerais, Brazil)   | Figure 10.1 deleted.  |
| 564 | 68097 | 10 | 73        | 0         | 0       | 0       | Hong Kong is not a country as indicated in Figure10-1. It is suggested to change "Hong Kong" to "Hong Kong, China" in Figure 1 and change "countries" to "countries and regions" in the title. (CHINA)  | Figure 10.1 deleted.  |
| 565 | 73188 | 10 | 73        | 0         | 0       | 0       | Figure 10 -1: This figure seems out of place in a chapter on key economic sectors. Suggest deleting or moving to another chapter. (UNITED STATES OF AMERICA)  | Figure 10.1 deleted.  |
| 566 | 73189 | 10 | 73        | 0         | 0       | 0       | Figure 10-1: The text mentions "assessed studies" for but there is no information on multiple studies behind the data. (UNITED STATES OF AMERICA)   | Figure 10.1 deleted. Sources added in the text.   |
| 567 | 78930 | 10 | 73        | 0         | 0       | 0       | Figure 10-1. This figure does not show any of the author's described patterns. Interpretation is incorrect. The source of this figure (Toth, 2013) is an unpublished reference. Figure should be deleted since does not support anything. (VENEZUELA, BOLIVARIAN REPUBLIC OF)   | Figure 10.1 deleted.  |